FEBRUARY, 1944

VOLUME 34 • NUMBER 2

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MEN

Do you want to Stand out in Aviation....?

Do you want to hold a position of responsibility and leadership in America's most promising industry? Then don't hesitate. Aviation is still young. You can still get in "on the ground floor." The sooner you obtain your technical training, the sooner you can cash in on the many opportunities we all know exist and will continue to exist.

You may feel that with the great expansion of war-time aviation, the industry may be overcrowded after the war. It may be, but not with men thoroughly trained for this technical work. THE EXPANSION OF AFTER THE WAR AVIATION AND ITS FUTURE DEPENDS UPON AND NEEDS JUST SUCH MEN. That is the kind of training Curtiss-Wright Technical Institute offers you. It makes you the kind of man the Aviation Industry or the Army Air Forces want; the kind they cannot do without!

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Curtiss-Wright Technical Institute's intensive and specialized courses in Aeronautical Engineering and Master Aviation Mechanics provide you with the necessary knowledge and skill in aeronautics. They give you the basic foundation for leadership and responsibility. They are designed primarily to help win our war and at the same time to insure your future . . . to make more money for yourself and make you independent and self-supporting for life.

The high standing of Curtiss-Wright Technical Institute is indicated by Mr. Donald Douglas, President of the great Douglas Aircraft Company, in choosing this school for his own son's training. In addition, this school was selected to train Army Air Force mechanics by our government in 1939, long before the war.

CURTISS-WRIGHT TECHNICAL INSTITUTE, one of the oldest, largest, and most progressive aeronautical schools, is located in the heart of Southern California's giant aircraft industry. It is recognized the world over as an institution offering the highest type of Aviation training available. This training has been proven by the success of thousands of its graduates in all phases of aviation activity, both civil and military. WHAT IT HAS DONE FOR THESE MEN IT CAN DO FOR YOU. But you must ACT NOW . . . Don't delay.

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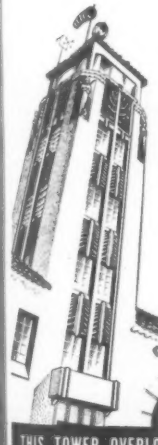

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Trail Blazing in the Skies

PIONEERING NEW METHODS

HOW GOODYEAR AIRCRAFT CORPORATION SERVES THE AIRCRAFT INDUSTRY

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5. *By building complete airplanes and airships.*

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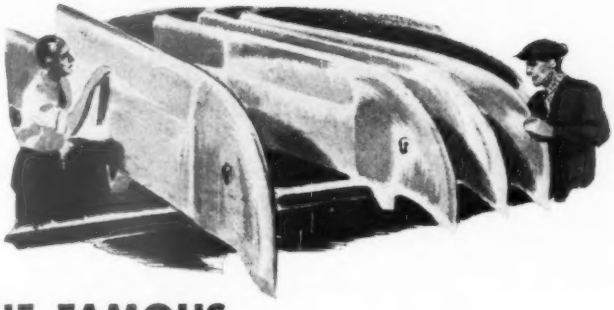

THE FAMOUS MARTIN B-26 MARAUDER

is equipped with major flight control surfaces, subassembled by Goodyear Aircraft. Since pioneer days Goodyear has been privileged to furnish Martin with many parts and accessories, and is one of its principal wartime suppliers.

BUY WAR BONDS to Speed Victory

GOODYEAR AIRCRAFT

But our light won't stay UNDER the Bushel...

MINNEAPOLIS-MOLINE
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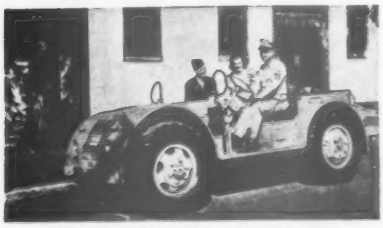
MODERN FARM MACHINERY

THE *Original* "JEEP" ... a child of Minneapolis Moline

The Original Jeep on maneuvers in 1940

Six-wheel Jeep pulling anti-aircraft gun



Sergeant O'Brien at the wheel of new four-wheel Jeep

Current national publicity has obscured the fact that the first war machine named "JEEP" was born at Minneapolis-Moline and christened at Camp Ripley, Minnesota (with apologies to Ripley —"Believe it or not").

Back in 1938 Minneapolis-Moline engineers were already experimenting with the conversion of a farm tractor to an artillery prime mover; and in 1940, collaborating with Adjutant General E. A. Walsh, Commander of the Minn. National Guard, models were tested in maneuvers at Camp Ripley.

This new MM army vehicle was not a crawler tractor, truck nor tank, and yet it could do almost anything and it knew all the answers. Because of this, it brought to mind the Popeye cartoon figure called "Jeep" which was neither fowl nor beast, but knew all the answers and could do most anything. The National Guardsmen therefore named the MM vehicle the "Jeep". The "Jeep" name therefore is not a contraction of the term General Purpose (GP), and if it really had been, no doubt "Jeep" would have been spelled "Geep".

Since the original MM Jeep, Minneapolis-Moline has designed several additional models of Military tractors in cooperation with Army and Navy officials. Several models of MM Jeeps are now being produced in quantity for the Armed Forces of the United Nations, and in use throughout the world.

Minneapolis-Moline also manufactures industrial tractors, and an extensive line of industrial engines. Many of these units are well suited to uses in and associated with the aviation industry.

MINNEAPOLIS-MOLINE POWER IMPLEMENT COMPANY
MINNEAPOLIS 1, MINNESOTA, U. S. A.

NOW AZIMUTH INDICATIONS STABLE AS A GYRO

The NEW GYRO FLUX GATE* COMPASS

... provides steady, extremely accurate indications even during steep dives, fast turns, in rough weather, and near the earth's poles

THE TRANSMITTER contains the Flux Gate. This sensitive earth inductor compass element is mounted in the wing where electromagnetic disturbances are at a minimum, and is held horizontal—even when the airplane pitches and banks—by an electrically driven gyro. Deviation is small and a special type compensator is used to neutralize this error, resulting in indications of magnetic heading that are practically perfect. Variation may be introduced into the system; then the dials show true heading. INDICATIONS are derived from signal voltages initiated by the Flux Gate, a triangular-shaped element whose three legs cut the earth's field at different angles, producing three different signals. This triad of signals varies with changes in heading. The tiny voltages are electronically amplified, and converted into torque, rotating the pointer of the master indicator. The associated Magnesyn* system is simultaneously set in operation, causing the repeaters to duplicate the master compass reading.

☆ ☆ ☆

The Pioneer* Gyro Flux Gate Compass System is an important member of "The Invisible Crew" of precision equipment which more than 30 Bendix plants are speeding to world battle fronts. Eclipse-Pioneer Division, Teterboro, New Jersey.

PIONEER INSTRUMENTS

*TRADE MARK OF BENDIX AVIATION CORPORATION

THE INVISIBLE CREW Bendix Aviation Corporation

The Birdmen's Perch

WE'VE DONE IT AGAIN!

IN LINE WITH our tradition of giving the latest and the best to Perch Pilots, we have scooped the world—*maybe the universe!*—to bring you the Al-Flutter line of Prefabricated New Year Resolutions.

No fuss, no trouble—simply check any 5 of the following 5 promises:

- ☐ **1. I will buy an *extra* War Bond.**
- ☐ **2. I will give some more blood.**
- ☐ **3. I will use Gulfpride Oil.**
- ☐ **4. I will use Gulf Aviation Gasoline.**
- ☐ **5. I will remember that 70% of airplane accidents are caused by stalling out of a low turn.**

Major Al Williams,

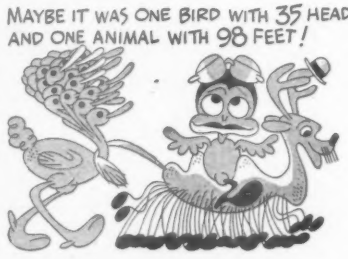
alias "Tattered Wing Tips" Gulf Aviation Products Manager, Gulf Bldg., Pittsburgh, Pa.

BRAINTWISTER

A mess officer in North Africa got a bill from the local butcher for "meat and fowl with 36 heads and 100 feet." He finally was able to figure how many animals and how many birds this strange itemization represented.

The question is, can you?

If you can't, we'll send you the answer for a post card.

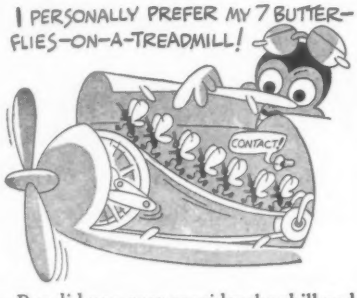


55 INCHES—2200 HORSES

As the crow flies, 55 inches is a minor distance.

In fact, you can stretch your hands that far apart. Nevertheless, airplane engine makers were able to cram 575 horsepower into an engine only 55 inches in diameter, way back in 1927.

Today, engines are being built that deliver 2200 horsepower . . . and they're still 55 inches in diameter! That speaks pretty highly for the skill and ability of the engine makers, doesn't it?



But did you ever consider the skill and ability required to perfect a lubricant that could take the *stupendous* punishment of such an engine? We mention that because we're pretty proud of our laboratory men.

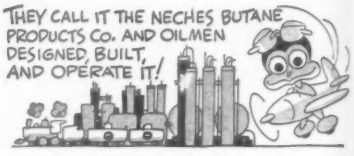
We're proud of their technique of refining a lubricating oil from crudes—*and then refining it some more!* They call this technique the Alchlor Process. We call the oil Gulfpride.

And because the *extra* refining step gets *extra* sludge-makers and carbon-formers out of Gulfpride . . . Gulfpride gives *extra* protection—even to engines of 2200 hp.

246,000,000 POUNDS OF RUBBER—COMING UP!

24 months ago, Gulf and four other petroleum companies had an idea.

Today, that idea is a multimillion dollar butadiene plant which covers 314 acres and will make enough butadiene to give America *246,000,000 pounds of synthetic rubber a year!*

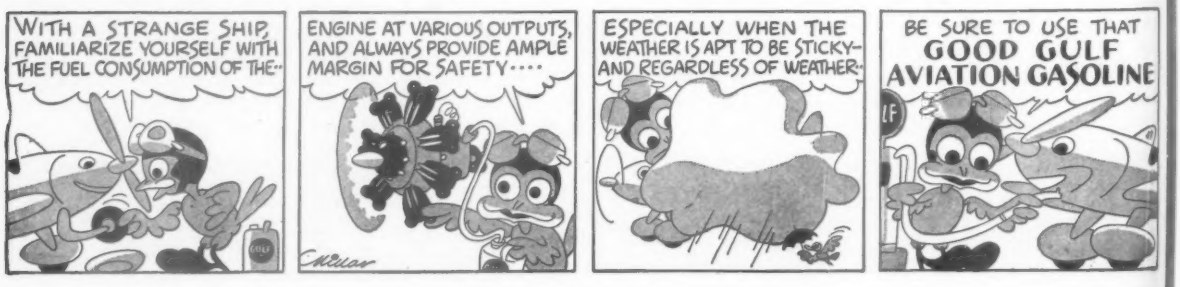


This incredible production record is an example of how industrial teamwork is solving our war problems almost as fast as they come up. And it's also an example of the amazing range and diversification of Gulf's war activities.

Gulf Oil Corporation and Gulf Refining Company...makers of

GULF AVIATION PRODUCTS

OIL IS AMMUNITION—USE IT WISELY


WITH A STRANGE SHIP, FAMILIARIZE YOURSELF WITH THE FUEL CONSUMPTION OF THE..
ENGINE AT VARIOUS OUTPUTS, AND ALWAYS PROVIDE AMPLE MARGIN FOR SAFETY....
ESPECIALLY WHEN THE WEATHER IS APT TO BE STICKY- AND REGARDLESS OF WEATHER-
BE SURE TO USE THAT GOOD GULF AVIATION GASOLINE

To buy Peace sooner...buy more War Bonds than you ever thought you could!

Sign of another headache for the Axis

DON'T THINK that America's job against Japan and Germany is now almost done. The Axis fights with undiminished fury.

More. The Axis still has abundant matériel. For enormous Axis stores of planes and other battle gear have accumulated during five years of their own all-out production.

To help overwhelm such enemies, the U.S. air industry faces a job of production that is titanic—far beyond the resources of any other people on this earth. It must create greater and ever greater air might. It must drive ahead night and day toward an air power never before dreamed of.

The Northrop group of airplane designers and builders shares in this all-consuming task. To the job they bring not only the skills of production but a forward looking concept in aerodynamic design.

The warplanes devised and being produced by the Northrop group will speak for themselves in the skies of battle. And as they speak, the Northrop group will be working on—creating and testing the still more deadly Northrop aircraft to come.

Smithsonian Institution enshrines famed Northrop "Gamma"

The Northrop group draws upon the same "know-how" that created the Northrop "Gamma". The airplane pictured is the one flown by Explorer Lincoln Ellsworth over the Antarctic, and is now in the Smithsonian Institution. Aerodynamically in advance of its time, the Gamma, built in 1933, pioneered the use of split trailing edge flaps now widely used on American military and transport aircraft. The Gammas were the first airplanes to be used as attack bombers.

NORTHROP *Aircraft, Inc.*

NORTHROP FIELD, HAWTHORNE, CALIFORNIA, U. S. A.
MEMBER AIRCRAFT WAR PRODUCTION COUNCIL, INC.

More bombs on target... more planes home!

WHEN ENGLAND DUG OUT of the rubble, the task was to take air warfare to the German enemy. Because of the human ceiling on production, every bomber was precious beyond price. Every crew was part of the blood of British self-preservation. Every bomb was critical. The objective was—more bombs on target, more planes and crews safely home!

What new flight training could assure this dual objective? A new device was called for—*a team-work trainer*—for pilot, navigator, radio operator, bombardier. A celestial navigation trainer, reproducing the heavens at night. A trainer which would "fly" over valleys and mountains, which would show the moving terrain below, and yet be anchored to the ground!

Could such a device actually be contrived, and built?

The problem was given Link. Link engineering provided the answer.

"Secret weapon" until lately, the Link Celestial Navigation Trainer is now, and for some time has been training the United Nations air forces. The objective is being achieved—*more bombs on target, more planes home!*

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Makers of Link Trainers, Celestial Navigation Trainers, Link Aviation Sextants, Collimators.

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ion looks to Link for crea-
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of manufacture. Look for
ame LINK *on precision*
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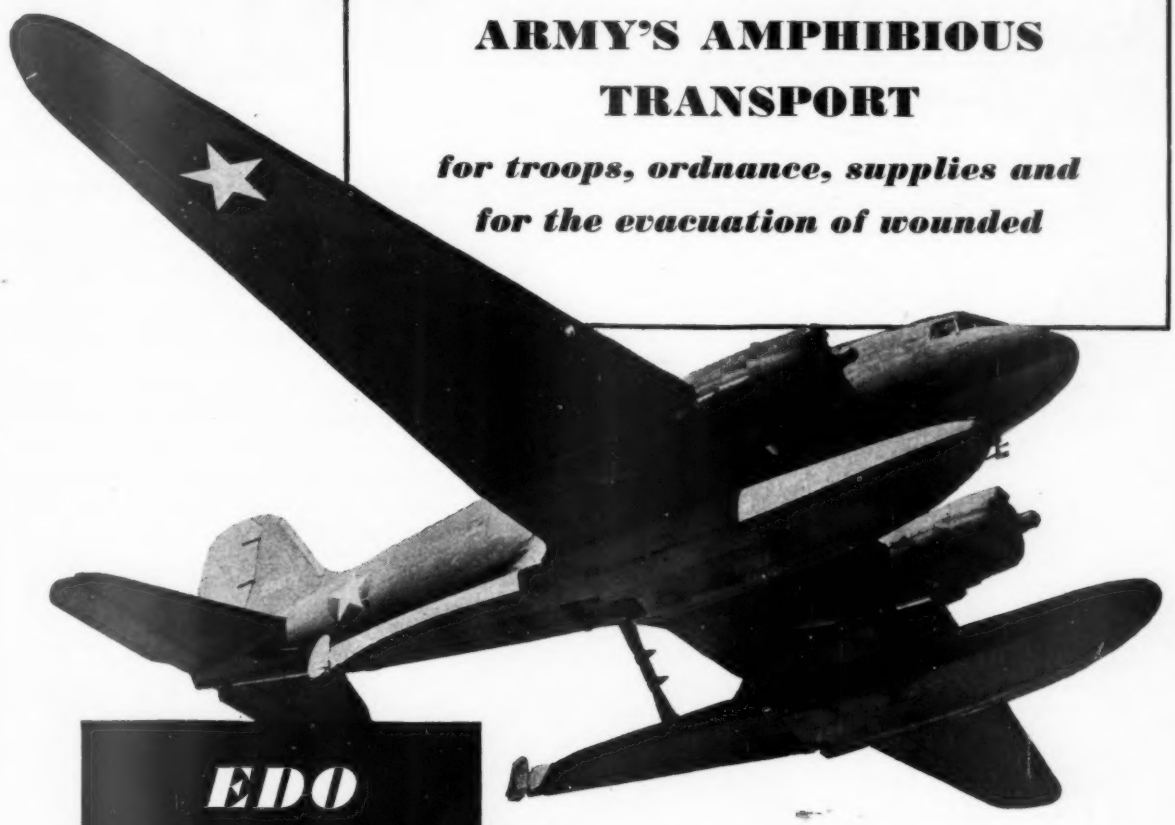
★ ★

ARMY'S AMPHIBIOUS TRANSPORT

for troops, ordnance, supplies and for the evacuation of wounded



EDO AMPHIBIOUS FLOATS

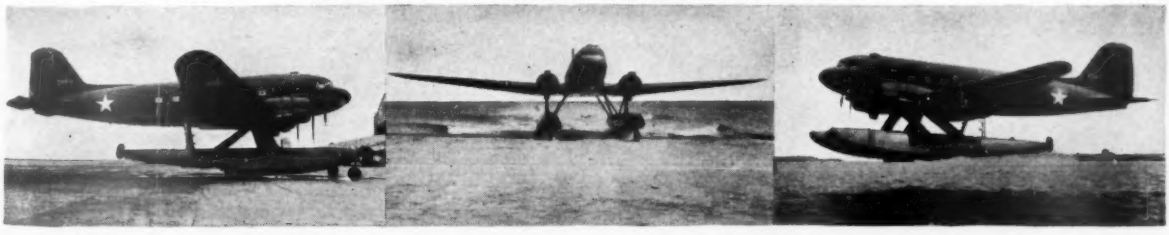
with retractable wheels

built for the needs of AIR-SEA-LAND WARFARE

An Edo achievement—Developed by Edo engineers, these giant twin floats, equipped with retractable wheels for operation from beaches and landing fields, represent a notable war-time advance in the design of seaplane float gear.

EDO AIRCRAFT CORPORATION, 414 SECOND STREET, COLLEGE POINT, L. I., N. Y.

Photographs show the Douglas C-47 "Skytrain" on Edo Model 78 Amphibious Float Gear.



★ EDO FLOAT GEAR ★

SERVES THE UNITED NATIONS

AAC

★ **ALONG THE PANAGRA ROUTE** is located AAC transmitting equipment at approximately 30 different points in Colombia, Ecuador, Peru, Chile, Bolivia and Argentina—forming the nucleus of the radio navigation and communications system.

Panagra is today primarily devoting its personnel and facilities to maintenance of aerial lifelines between the Americas, across which are speeding men, mail and materials vital to the success of the democratic war efforts.

ODAY, the skill and ex-rience of the AAC Elec-nics and Hydraulic Di-ions are devoted to serv-g a fighting America. owever, AAC engineers planning ahead for the eat peacetime future en new and improved AC products will be ready meet postwar needs.

ight) Type 500 Trans-tter as designed by AAC Panagra. Consists of lti-channel transmitting uipment, 1,000 watts h channel. Two chan-ls may be operated simul-neously. Telephone and egraph transmission. Fre-ency range 250-550 KC d 1500-12000 KC.

AAC Products

Rudolph C. Walker PRESIDENT

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Manufacturers of PRECISION

Burbank, Calif. Kansas

TRANSMITTERS

AND OTHER COMMUNICATIONS EQUIPMENT

for

Dependable Operation Of Airlines And Various Communication Services

★ Today, AAC transmitters and other AAC communications equipment play a vital part in dependable operation of warplanes on the fighting fronts, as well as airlines serving the war-busy Americans on the home fronts.

AAC Electronics Division has won distinctive leadership as one of the country's large producers of radio transmitting and receiving equipment. One outstanding example of AAC communications engineering is the equipment designed and built to meet the specified needs of Pan American-Grace Airways, Inc. Consisting of a multi-channel 1,000 watt transmitter, this equipment is used by Panagra for radio homing and communication purposes. It represents one of a complete line of transmitting equipment for use by airlines or services having similar communication needs.

At the present time practically all AAC facilities are devoted to war production. However, your inquiries are welcomed now for commercial equipment which can be supplied in limited quantities if adequate priority ratings are available.

AAC products in transport planes, cargo carriers, troop ships, bombers . . . airport traffic net, police or other services where communications are crucial, can be depended upon as expertly engineered and built to the most efficient performance standards.

Products of **ELECTRONICS DIVISION**

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(Below) Panagra airliner delivers important cargo of mail and passengers.

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With a thundering roar the Navy's Corsair fairly leaps off the carrier. Two thousand horsepower is the reason — plus twenty-six years of experience in designing first-line warplanes for America's fighting forces.
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Stratford, Connecticut
ONE OF THE FOUR DIVISIONS OF UNITED AIRCRAFT CORPORATION

COURTESY DOUGLAS AIRCRAFT

By Appointment to His Excellency, Johnny Skytrooper, U. S. A.

"Geronimo, look out below" . . . and Johnny Skytrooper hits his chute to spearhead Allied attacks on every front. As one of the largest chute producing organizations in America, the men and women of Standard Parachute Corporation proudly and diligently back the paratroop attack with a prodigious output of "parachutes with a pedigree."

Now and for the duration manufacturing by appointment to His Excellency Johnny Skytrooper, STANPAR in the peace to be won will be manufacturing personal items by appointment to Their Excellencies Mr. and Mrs. Free Citizens of the World.

To hasten that day

BUY MORE WAR BONDS

Stanpar

STANDARD PARACHUTE CORPORATION SAN DIEGO, CALIFORNIA, U. S. A.

The Stars—always the wonder of the human race—have more than ever become a guide and a savior to man in this War, though they are largely eclipsed in our thoughts by the sciences of the Earth and the Air.

Celestial navigation—for centuries the guiding protection of mariners—is now guiding our Bombers and Air Transports over thousands of miles of trackless ocean and uncharted wilderness, day and night, with uncanny accuracy.

Thorough training in the science of the Heavens is as important to our long-range Air Navigators as their training in the use of compass, radio and instruments. Like the Pilots who fly them, these navigators receive much of their air training behind reliable engines built by Jacobs.

JACOBS AIRCRAFT Engines

POTTSTOWN, PENNSYLVANIA, U. S. A.

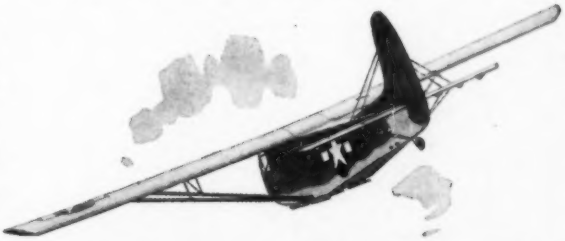
CONFUSING...ISN'T IT?

This is not one of those "I-forgot-to-take-the-cover-off-the-lens boners." It is a factual illustration of a glider-borne infantry attack somewhere behind the enemy's darkened lines.

If it seems confusing to you—just think how confusing it must seem to the opposition. Seeing nothing. Hearing nothing. Then . . . *curtains!*

That's the way these glider troops work—in the dark. But it is not the way the WACO engineers who designed these gliders work. For, in the performance of these craft and the long line of comfortable, dependable, easy-to-fly WACO planes which preceded them, there is an overwhelming evidence of WACO'S crystal-clear vision.

Right now, this vision is paying dividends in victories. But tomorrow its dividends will be in the shape of better planes and better flying. THE WACO AIRCRAFT COMPANY, Troy, Ohio, U. S. A.



WACO AIRPLANES

ALL ARMY CARGO-TRANSPORT GLIDERS ARE WACO DESIGNED

Rugged

Over hills and rolling valleys, these Beechcraft AT-11 bombing trainers carry out a mission. Their crews are preparing themselves for a rugged job — flying bigger bombers over Axis targets. How well they do that job depends greatly on their training . . . and as combat results testify, American airmen are superbly trained. Bombardiers, pilots, and navigators, more often than not, perfect their skills in Beechcrafts. . . The record of these Beechcrafts, in the gruelling grind of military training service, reaffirms the reputation earned by their commercial prototypes in prewar service from Aklavik to Little America — a reputation for doing efficiently and capably any job assigned to them, no matter how rugged that job might be.

Beech Aircraft

CORPORATION

BEECHCRAFTS ARE DOING THEIR PART

WICHITA, KANSAS, U. S. A.

Fortresses over Bolzano, Italy, to bomb city's railroad yards.

THE MISUSE OF AIR POWER

A distinguished military analyst charges that, even in battle, we disperse our air power on widespread targets instead of concentrating it in support of ground troops.

By Brig. Gen. HENRY J. REILLY, O. R. C.

IS THE great power of aviation being used to its fullest extent today to bring about the unconditional surrender of our enemies which President Roosevelt has demanded?

The answer is: NO!

This is shown clearly by the course of the war—particularly the military events of the past year.

During that year our aviation has reached a strength probably greater than that of the air forces of any other country. If that aviation had been used to its maximum power from the military viewpoint of *concentration on vital areas one at a time* instead of being *dispersed through attacks on numerous areas at the same time*, more than a year after we landed in Africa:

Italy would not still be largely in German hands.

Russia would not have fought through the great campaigns of the past year without decisive help.

The Balkans could have been invaded.

Germany would not have had the time to complete her seacoast defenses from Norway to Spain, to finish a defense line facing Russia, to offset the disturbances in the Balkans caused by the surrender or dispersal of the Italian divisions, and to prepare a defense of northern Italy.

Holding a central position, the Germans can concentrate their planes on any front, which Allies can do only with difficulty.

As a consequence, the recent Moscow conference would have been able to make plans for an immediate final attack on Germany in the way that Marshal Foch, General Pershing, Marshal Petain and Marshal Haig made their plans in the late summer of 1918 for the final attack which began September 25 and 26 of that year and led to the armistice on November 11.

All these are consequences of not making the proper use of air power to speed the advance against our enemies. While boasting that "time" is on our side and against our enemies, we have allowed them sufficient time to prepare themselves against decisive blows still many months in the future.

It is essential, unless the war be dragged out at tremendous cost in lives and treasure, that the maximum use be made of our military forces—including aviation—to bring victory as quickly as possible.

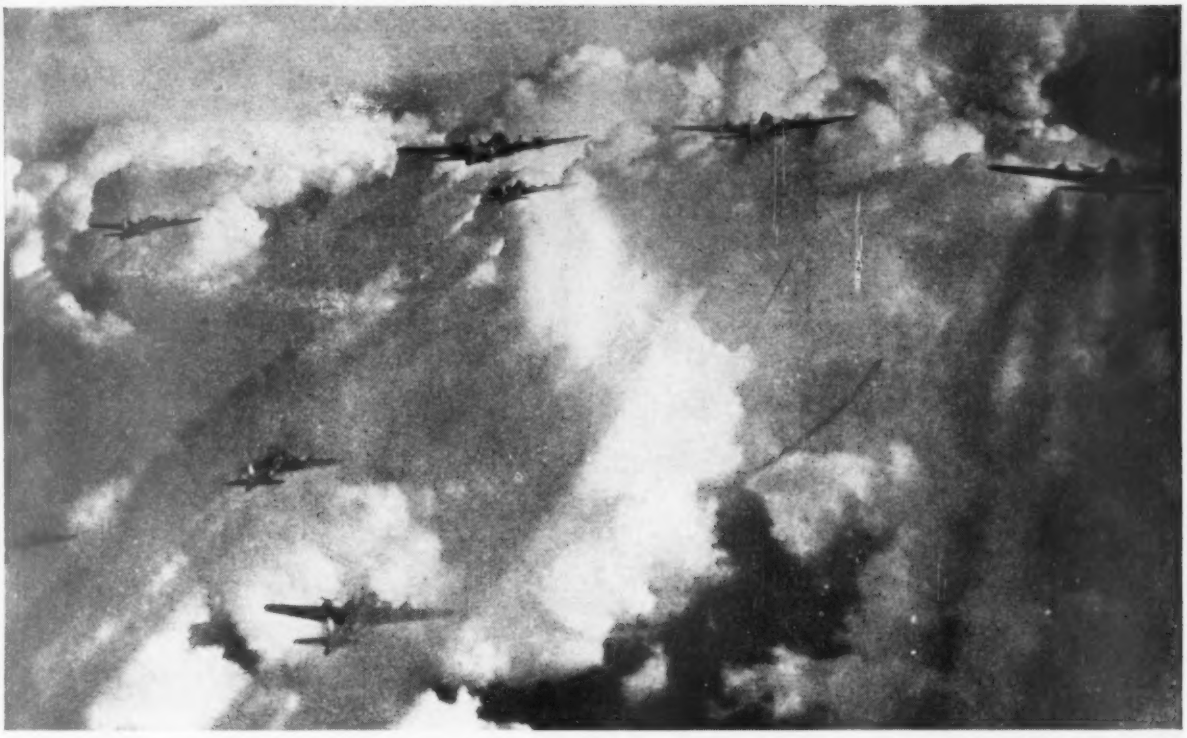
The issue as to how our air force is to be used is simple and clear: Do we continue to follow the theories of Douhet or do we adopt the theories of Napoleon and other great military leaders?

Douhet held, in essence, that a country could be so smashed up by the wonderful powers of aviation that it could not wage war.

Napoleon and every other military leader in the past won by defeating the enemy's armed forces in battle, for with their defeat everything else falls.

The followers of Douhet claim that aviation is something entirely new; that Napoleon and his followers knew nothing about it and their principles of warfare cannot apply. They ignore the fact that aviation is only a new method of carrying weapons, the principles of which are not new. Aviation is handled by the same kind of human beings that fought wars when only the ground and the surface of the sea could be used as battlefields.

One of the claims of Douhet and his



Streaming trails of vapor, Fortresses drone toward Bremen. The author would use even these bombers to support ground troops.

disciples has always been that much time could be saved by carrying out their theories of the use of air power.

The followers of Napoleon say: "In aviation we have a wonderful new military force. By adding its powers to the military powers of ground and sea forces we can bring a much greater armament to bear on the armed forces of our enemies. Thus, through aviation, we can insure their decisive defeat much more quickly than was formerly true."

The Douhetites do not answer this argument. They avoid meeting it by changing the subject and claiming that the followers of Napoleon are trying to make aviation subordinate to ground and sea forces and thus prevent its being used to its maximum military capacity. Ground troops "do not understand" aviation, they say, and cannot use it as it should be used.

It is time to meet this argument now because the war is nearing a critical stage where following Douhet can conceivably bring us to military disaster.

Douhet predicted the present war. He also predicted that German aviation would knock France out in two days.

Actually, with overwhelming strength on ground and in the air, it took Germany 40-odd days to put France out.

And Germany accomplished this, not, as was so widely proclaimed by our amateur strategists, with 200,000 German athletes manning tanks and planes, but with a total of more than 200 divisions, only nine of which were panzer armored divisions, improperly called tank divisions. A few more of the 200 were motorized divisions in which the infantry rode in trucks. The rest were divisions in which the infantry marched on foot carrying its own packs and rifles. Except for the antitank and antiaircraft guns the artillery was horse-drawn.

German aviation did not follow Douhet's theory in the Battle of France. Its primary function was to support the troops in all ground fighting and help them forward. In the preliminary stages the German planes bombed lines of communications and—above all—the airfields, not only to destroy the air facilities but the planes caught on the ground. During the battles they helped the artillery by bombing all the artillery targets. They helped infantry and tanks by heavy bombing of all enemy infantry, tanks and machine guns, and by dive-bombing specific military targets. They never limited themselves to bombing the rear areas back of the battlefields, and during the actual battles they came to the direct support of the troops. The author has voluminous data gathered in France proving this to be their method.

Youngest infantry brigade commander in the AEF, ex-editor of the Army and Navy Journal, General Reilly supported Billy Mitchell on many points, disagreed with him on others. The general does not oppose strategic bombing but believes decision can only be brought about by tactical use of air in support of ground troops against enemy armies. While FLYING believes that strategic bombing can be decisive as the principal phase of operation, it nevertheless feels that General Reilly's views should be heard respectfully. **The Editor.**

Today there is no evidence that the Germans are changing their plan of air-ground forces operating together under one command. Their failure to follow Douhet has led to the general belief among the Allies (how often have you heard this statement?) that "the Germans do not understand air power."

All this statement really means is that the Douhetites disagree with the Germans' use of aviation. If so, they must also disagree with the Russians because the Russians are using aviation much like the Germans—concentrating it in direct support of their ground forces.

The German victories were obtained by using *all* their armed forces on the ground and in the air concentrated in a combined attack upon the ground and air armed forces of their enemy.

Throughout military history the greatest problem military leaders have had to meet has been the rapid concentration of their forces within a vital area. This is true because the concentration of overwhelming military force on an enemy is the surest and quickest way to defeat him decisively.

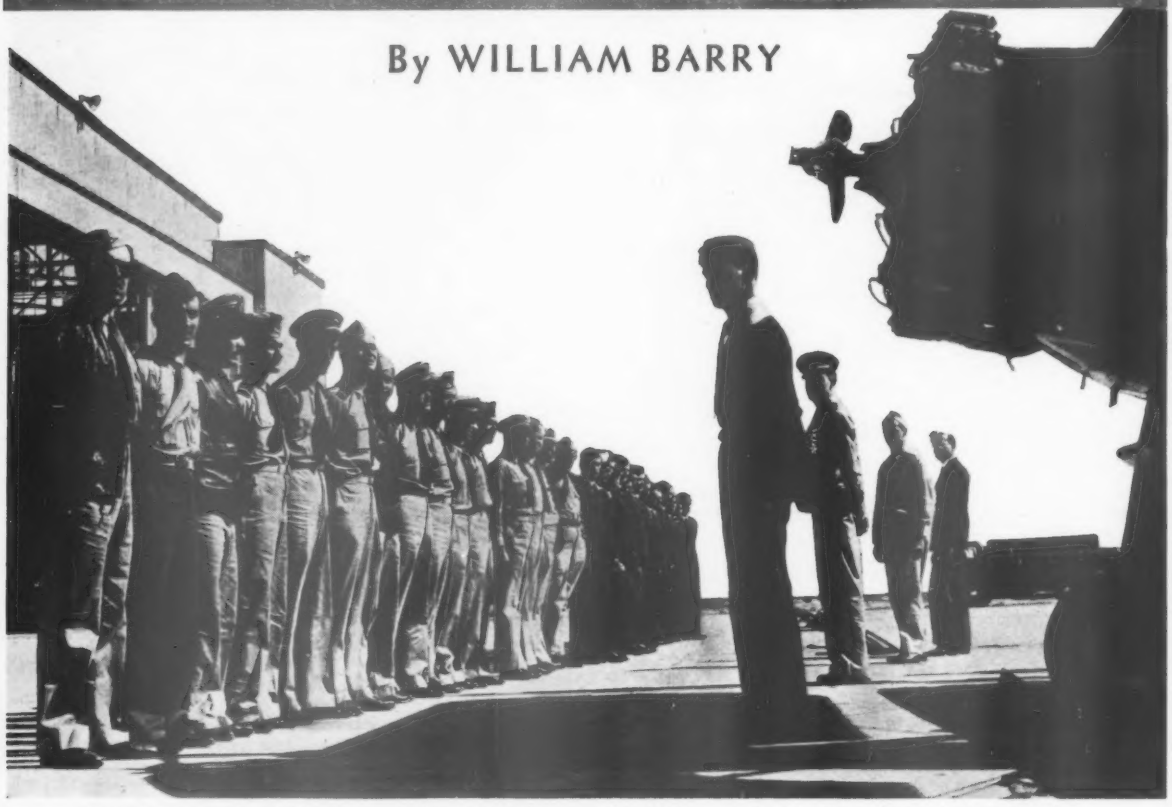
It has always been true, first, in *strategic movements*, to get the greatest military force into battle; and second, of *tactics* in battle to bring about an overwhelming blow on some part of the enemy's forces.

Before the invention of firearms, the answer to both the strategical and tactical concentration of force was manpower. With the development of firearms, the day began when *tactical flexibility*—that is, flexibility in battle—did not depend

(*Continued on page* 86)

ALL-AMERICAN AIR TEAM

By WILLIAM BARRY



Latin American student pilots line up before training hangar. The third group of such pilots will start training in spring.

U. S. aviation practices will be carried to Central and South American countries by new group of trainees nearing graduation.

THE overworked term "good neighbor" is being given real meaning by an Inter-American aviation training program, now about to enroll its third year's quota of students.

This spring 119 young men from the other Americas will be given the opportunity to come to the United States and qualify as pilots, aviation mechanics or aeronautical technicians.

They will succeed the 110 aviation students from South and Central America currently training here, who in turn followed a group of 484 brought to this country by the United States Government starting in December, 1941.

The Inter-American aviation training program is conducted by the Civil Aeronautics Administration, with funds from the Defense Supplies Corporation and the Department of State.

The program aims primarily to provide American hemisphere personnel for aviation in the Americas. Until 1940, aviation in many South and Central American countries was under strong Axis influence. New blood was needed not only for replacements when this influence was wiped out, but to be ready for the inevitable expansion of air service to the south in war and post-war operations. The success of the program in this respect is attested by letters reaching the CAA from graduates of the first classes.

Most of the Brazilian trainees are in the military forces of their country, now that it is an active participant in the United Nations war effort.

A total of 340 have returned home, many being employed in the civil aviation of their own countries. Twenty-two of the original trainees are staying on in this country as instructors for their fellow citizens in subsequent programs, while 92 remain here to gain additional practical training through paid employment in aviation.

Although plans for Inter-American training in the United States have been projected for 1945, the long-range goal is to enable the other American republics to establish their own training facilities, and a start in this direction already has been made by Mexico.

All Inter-American pilot trainees are given courses to qualify them for an instructor's rating as well as a commercial pilot's certificate with instrument rating. Thus equipped, Mexican graduates of the program now are being employed as instructors at two new elementary flight training centers in their own country, located at Puebla and Aguas Caliente. The Puebla center already has graduated several classes, the first of which went on to Purdue University for secondary flight training in the CAA program. The airplanes used are 20 Interstate *Cadets*, furnished under Lend-Lease arrangements. Three CAA experts, headed by O. K. Haley, act as consultants to the Mexican government in supervising the program.

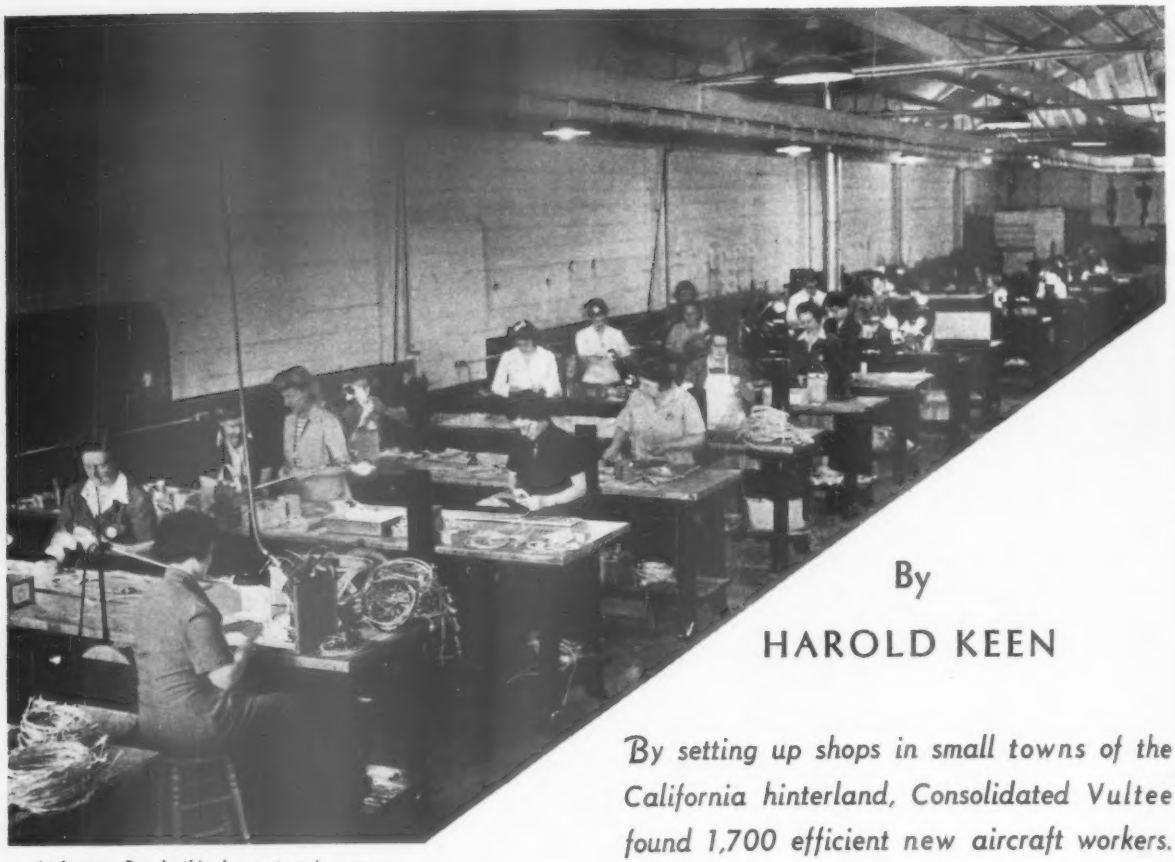
As assurance that Inter-American trainees will put their knowledge to the intended use, a condition for award of

(*Continued on page* 155)

The long-range U. S. goal is to enable other American republics to establish their own training programs. All these pilots are receiving training to qualify them for an instructor's rating as well as a commercial certificate.

William Rivas Vargas, son of Nicaraguan air chief, trains as instructor mechanic.

Latin American trainees at Henson Flying Service, Hagerstown, Md., busy with homework. Two thousand instruction hours for mechanics are crowded into one-year course.



At Laguna Beach, this shop set up in a vacant garage fabricates electrical harnesses.

By

HAROLD KEEN

By setting up shops in small towns of the California hinterland, Consolidated Vultee found 1,700 efficient new aircraft workers.

'FEEDER' FACTORIES

SHOW a west coast aircraft manufacturer a way to recruit 1,700 new workers without touching the already congested housing and transportation facilities of his own harassed community, and he'll probably install you as an executive vice president in charge of pulling-rabbits-out-of-hats.

But all you need do is point to the now-famed "feeder shop" plan of Consolidated Vultee Aircraft Corp., celebrating in December the first anniversary of a highly successful existence in which has been proved that if you can't bring the Mohammed of labor to the mountain of manufacturing, the reverse process is quite possible.

Last winter, when the onetime tremendous flood of job applicants to meet normal turnover plus the need for expanding payrolls began to dwindle alarmingly, Convair officials looked beyond the "dead-end" street that San Diego, in the southwesternmost corner of the United States, represents in the national labor market.

Their thoughts flicked into the overlooked by-ways—the small rural communities which war production seemed to have passed by—and they had hunches subsequently confirmed by on-the-spot surveys. These hunches were:

(1) Plenty of labor, especially women now idle, ought to be available in resort centers and the pleasant little towns sprinkled through southern California's great citrus belt.

(2) Ready-made shop space, vacant as result of the blitzing into oblivion by priorities of many a garage, store and small manufacturing establishment, could be located.

Why not set up our own shops in these communities to help the parent plants in San Diego meet continually increasing production demands of the Army and Navy? asked C. W. Perelle, Convair vice president in charge of manufacturing.

The answer today is the full-throated chorus of 11 feeder shops in full operation, with 1,700 workers—90 per cent of whom are women. They're located in places where the city fathers would have flung up their arms in horror, during prewar days, at the very thought of a factory in their midst.

Places, for instance, like Laguna Beach, the Riviera of southern California, an artist's colony, a playground for vacationers and a retreat for the yacht-and-chateau gentry. Or Coronado, a spot where one could meditate peacefully while lolling at the edge of the Pacific surf.

But these are the very towns that have plunged with vigor into the chance to help build bombers.

Today the network of feeder shops also extends through Santa Ana, the citrus empire capital, headquarters of the system and site of three shops; Anaheim and Placentia, also in Orange County; Huntington Beach, another seashore resort; Pasadena, the roosting place for Los Angeles' millionaires; Banning, a desert foothill town near famed Palm Springs; and Riverside, another citrus citadel.

In "ghost buildings" where previous businesses had failed (Pasadena, the exception, converted its indoor badminton club into a feeder shop), a unique industrial army is producing *Liberator* and *Catalina* bulkheads; plexiglas enclosures; upholstering for plane interiors and seat pads, motor covers; sheet metal sub-assemblies; electrical harnesses; emergency maintenance kits and hydraulic tubing.

Mrs. John H. Towers, wife of the vice admiral, is a loyal worker at Coronado.

The Coronado (Cal.) feeder shop is devoted to sorting the hundreds of thousands of rivets swept up from Consolidated Vultee factory floors in San Diego.

And at Coronado, in an all-women shop, rivets swept up by the thousands from assembly line floors are salvaged, separated into various sizes and sent back to San Diego for another chance.

Herbert Bowling, Convair works manager, declares that the feeder shops already have made possible complete removal from the hard-pressed San Diego plants of the plastics department, where plexiglas, arriving in sheets, is formed over molds into correct shapes, and polished. The electric bench department has been reduced by 80 per cent at the home plants. Eighty-five per cent of the upholstery for Convair bombers produced by the San Diego division comes from the feeder shops.

And enough floor space has been saved to add, in effect, another huge factory building to the array in San Diego. Vacancies left when equipment was moved from San Diego to a feeder shop were promptly utilized by other departments which had been crying for more room to speed up their own output. Workers who "lost" their machinery in San Diego were moved to other operations that required additional help.

Work moved to a feeder shop was of a relatively simple nature, and the townsfolk, most of whom had never been inside a factory before, learned quickly, serving a short apprenticeship at regular pay right on the job.

The workers, many of them middle-aged women, not only became adept at their tasks rapidly, but they pitched into the jobs with such patriotic fervor that units are being turned out in these country towns at a greater speed in many cases than at the home plant, according to Bowling.

Time studies have further shown that the company-controlled feeder shops (as a whole) enjoy an extremely favorable comparison with experienced subcontractors who have been producing the same article for many months. Personal supervision from the San Diego plant and conformity to the same production regulations and standards are responsible, Convair officials believe.

"We rarely have to re-work parts that come to us from the feeder shops," they say.

None of the shops is more than 130 miles from San Diego, and in the scheme of centralized control raw materials are shipped from San Diego to a warehouse in Santa Ana, about 100 miles away, then shuttled to the various shops. Into the warehouse also go finished parts and subassemblies for the return trip to San Diego and a place on the assembly line, with arrival figured almost to the minute.

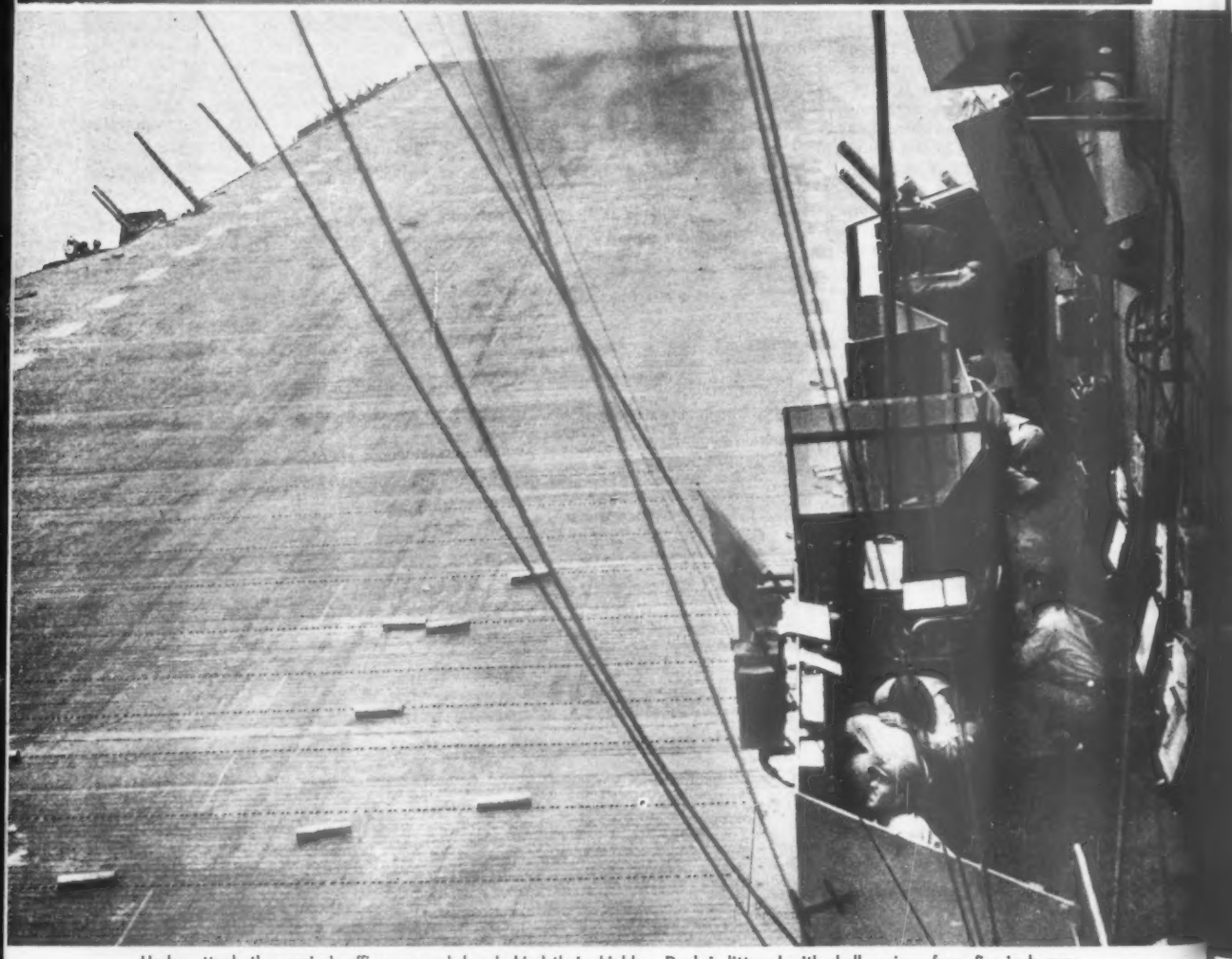
Two days are allowed above the shop production schedules for this smoothly flowing transportation system, and Convair officials, controlling the entire activity, don't have to tear their hair over the vagaries of some sub-contractors who occasionally may have trouble delivering on time.

One of the attractive features of the feeder shops has been the relatively small expense required to establish them. "Duration" leases usually were arranged and the tools, already in Convair's possession, simply have been shifted from San Diego. Procurement of heavy machine tooling was not necessary, because the feeder shops concentrate on small assemblies which can be produced with riveting hammers, electric drills, insulation strip-

(*Continued on page 96*)

Girls working on an electrical harness board at the Laguna Beach feeder shop. Ninety per cent of the 1,700 workers found in the feeder factories are women.

With Jap aircraft approaching, chalk message is flashed to pilot on take-off, giving directions to nearest friendly shore base in case carrier should be sunk.



Under attack, the carrier's officers crouch low behind their shields. Deck is littered with shell casings from five-inch guns.

RABAUL RAID

ON Armistice Day, November 11, a task force of U. S. carriers joined with land-based Allied bombers for a large scale attack on the harbor of Rabaul, New Britain. Aboard one of the carriers was FLYING's photographer, W Eugene Smith, who took the pictures on these pages. The carriers were in the process of launching a second attack when the Japs struck. Thirty-three Jap planes in formation attacked the ship carrying Smith but were so completely broken up by carrier-based fighters that only four or five planes got through to launch their bombs. Four bombs were near misses, two on each side. In its first combat the carrier downed 48 Jap planes, lost four.

Hellcat lands after first raid. The plane in air was waved off for new try. Rest of squadron approaches at upper right.

Near miss by bomb (probably 500-pounder) of stick that straddled the carrier. Planes on deck are Avenger torpedo bombers.

After morning raid a Hellcat crashed through cable barrier but pilot, securely held by shoulder straps, was unhurt. Below, crew mops up gas and oil, repairs the deck.

Unloading a 105-mm. howitzer from a bomber during New Guinea campaign.

Air War's Test Tube

By GEORGE JOHNSTON

Australian War Correspondent

War in the southwest Pacific battle laboratory has proved beyond dispute that the formula for victory is air power.

THE least air-minded person in the world could go to the Southwest Pacific front and become completely and fanatically air-minded within a week. For out there *all* power is based upon air power. Warships, even whole armies of khaki-clad American and Australian soldiers, are so utterly dependent on the little black specks that arrowhead through the Papuan sky that all fighting strength for attack or defense is limited by the number and efficiency of the combat aircraft that form the air umbrella. Without them any naval or military movement is impossible.

For 10 out of 15 months of the Southwest Pacific war I watched the great battle for command of the New Guinea skies from the battle area itself. For the balance of the time I watched, less anxiously, from mainland headquarters. And I have seen the development of a campaign that has many aspects unique by the standards of other theaters in this second World War.

I saw new methods of employing aircraft—methods for which the aircraft had never been designed but which were carried out on the basis of: "If it works, then go ahead; if not, then try something else." I saw new conceptions of the use of air power in support of fighting armies. I saw quality achieve victory over quantity. I saw a chunky Nova Scotian-born American, Lieut. Gen. George Kenney, build the Fifth American Air Force into one of the most magnificent air fighting organizations in the world.

Altogether the Southwest Pacific front has employed 19 main types of aircraft in combat areas since January 23, 1942, when the great struggle really began with the conquest of Rabaul by a Japanese task force which employed warships, 17,000 troops and an estimated 200 aircraft against a garrison that had no naval support, five serviceable aircraft and 1,400 troops. The garrison fell after a brief but bloody struggle and Japan was able to consolidate in Rabaul a major air base that has since become the whole key to Japanese operations in the Southwest Pacific.

Australia, fighting alone at that time, had as its air strength a handful of *Wirraways* (actually advanced trainer aircraft which were thrown in as fighters!) and a few Lockheed *Hudson* medium bombers and Consolidated *Catalina* flying boats. Since then both America and Great Britain have sent out squadrons of hard-hitting aircraft. In the whole campaign the 19 types of aircraft employed in combat areas have been:

HEAVY BOMBERS: Boeing *Flying Fortresses* and Consolidated *Liberators;* MEDIUM BOMBERS: Consolidated *Catalinas,* North American *Mitchells,* Martin *Marauders,* Lockheed *Hudsons;* TORPEDO BOMBER: Bristol *Beauforts* (Australian-made); DIVE BOMBERS: Douglas *Dauntlesses,* Vultee *Vengeances;* LIGHT OR ATTACK BOMBERS: Bristol *Beaufighters* (British), Douglas *Havocs;*

Screened by low trees, Anzac troops bomb up Mitchell for raid on Japanese from advanced Australian operational base.

FIGHTERS: Lockheed *Lightnings,* Bell *Airacobras,* Curtiss *Warhawks,* Supermarine *Spitfires* (British); LIAISON: *Wirraways* (Australian); TRANSPORTS: Douglas DC-3's and Lockheed *Lodestars* and *Electras.*

Because of the toughness of the battle and the limitation on types, some of the planes had to be used for various purposes. Lockheed *Hudsons,* for instance, were used as medium bombers, daylight reconnaissance planes and as supply transports in their spare time. *Wirraways,* although actually training planes, were first used as pursuits and later as artillery spotters, because there was nothing else to use! *Catalinas,* slow and cumbersome, were not only employed for general sea reconnaissance but were used—and are still used—extensively as night bombers and actually on some occasions as *dive-bombers! Beauforts* carried torpedoes or bombs, depending on the target, and filled in with ocean reconnaissance and convoy escort. *Fortresses,* built as high-level bombers, were employed as low-altitude attack planes, general reconnaissance machines and even as freight planes. In addition to their work as fighters, *Lightnings* carried out important photographic reconnaissance and, like *Warhawks* and *Airacobras,* were used on occasions as dive-bombers. The *Beaufighter,* built as a night fighter, was used almost exclusively as an attack plane. It was an air force in which improvisation and adaptation played a major part.

Its force was centered on Port Moresby, on the south coast of Papua, which General MacArthur had built up into the main operational base of the Southwest Pacific. The Japanese, using Mitsubishi twin-engine naval bombers with navy Zeros as top cover, began bombing Moresby in the first week of February, 1942. Our air defense consisted of five heavy antiaircraft guns, five *Catalinas* and four *Hudsons.* It was some weeks before the first fighters arrived—a squadron of *Warhawks* manned by skilled pilots of the Royal Australian Air Force.

Within a fortnight the Australian squadron was almost shot to ribbons but it had taken terrific toll of the enemy. The ratio of planes shot down was four to one in favor of the Australians de-

Control of the air means destruction of Jap shipping and protection for our own.

spite overwhelming Japanese superiority in numbers. All that was left of the gallant 75 Squadron of the RAAF was withdrawn and the first United States pursuit squadron to go into action in New Guinea came up with a stronger force of *Airacobras*.

The Americans were hampered by three factors. Despite cannon armament the *Airacobra* failed in performance at altitudes the Zeros selected for combat. The Americans were in combat for the first time in their lives. They met the Japanese navy flyers at a time when the Nips were riding the crest of the wave of numerical and tactical superiority. Martin *Marauders*, some of the world's finest medium bombers, had arrived at Moresby, and a squadron of *Flying Fortresses* diverted from Java was operating out of Queensland and using Moresby to refuel and bomb-up.

But over Moresby the Japanese had command of the air because of fighter

Air transports like these Skytrains moved and supplied whole divisions in the Southwest Pacific, flew more than 1,000,000 tons over the Owen Stanley range.

superiority. And over Rabaul, because of the extreme range, our bombers were forced to operate without any sort of fighter cover. The odds were very much against the infant Fifth Air Force and its allies of the Royal Australian Air Force.

For two months they swapped punches. Then, quite inexplicably, the Japanese command in the Southwest Pacific was changed. The army took over from the Japanese navy. Army flyers of quite inferior caliber to the navy men tried to carry on the job of securing Japanese air domination. The change was so obvious that it was staggering. Bomber formations in the navy days had been perfectly flown and even when they were cut to ribbons by fighter interception or accurate antiaircraft fire they continued their job with unfaltering formation and winged away homeward, minus one-third of their strength, as if nothing untoward had happened.

On one occasion we had a Japanese interpreter listening in to the enemy raiders on their own frequency as they came in to make an attack—18 heavy naval bombers flying in two lozenge-shaped formations. The planes were nearing the target when the formation leader—a man called Yamajiro—gave final orders in cool, terse commands, then the grey bursts of our antiaircraft fire flowered among the silver specks of the Mitsubishis. The leading plane lurched and dropped. It seemed to hang motionless for a while and then plummeted to earth trailing a great plume of oily smoke.

"Yamajiro—he has gone!" an excited Japanese voice cried.

There was an excited jabbering that was quite unintelligible.

Our *Airacobras* struck at the formation. Three more bombers whirled down in flames.

Again the excited pandemonium in which a voice could be heard saying "Sato. It is Sato!"

And then a quiet, slow Japanese voice came through the yammer: "Steady, men. Steady for Nippon!" And the formation moved ahead without the slightest faltering in its formation, dropped its bombs and roared away across the range.

With the arrival of the Japanese army pilots, however, things were very different. Bomber formations, when attacked heavily, usually scattered. Zeros were reluctant to give combat to our planes, particularly to the *Fortress* which, with its bristling .50 calibers, had become the most invulnerable of all Allied aircraft in the Pacific. Japanese fighter pilots no longer strafed up and down Moresby's tracks at tree-top height in devastating and frightening sweeps. The young pilots of the Fifth Air Force saw their opportunity. They pushed every plane they had into the air, punched as hard as they could at the Japanese, smashed their morale, robbed them of numerical superiority and established an air domination by sheer courage and flying skill.

That air domination has remained in our hands. It has been our unbeatable trump card in campaigns by air, sea and land. It has been the greatest single factor contributing to the long string of victories scored by men in the Southwest and South Pacific areas. It has been, until very recently, a qualitative rather than a quantitative superiority. It has been the supreme triumph of courageously employed air power, not only over sea power but in overcoming the various tangled problems of purely military operations in island warfare, in jungle fighting.

Out of this great struggle for command in the air has emerged, perhaps for the first time, the pattern of conquest for eventual victory against Japan. It will come when the weight of Allied production is added to the ascendancy over Japanese airmanship that we have won. It will come by employment of air power on a grand scale in the way in which it has been employed on a small scale in the tough battles of New Guinea—the use of three-level fighter screens, the employment of aircraft in various ways, the redesigning of armament to meet special circumstances, and, above all, in the use of large numbers of escorted transport planes to remove all the logistical problems that have previously hamstrung any large force attempting jungle penetration or island conquest. In the near future it might be possible to visualize armies thrown across great stretches of sea and supported and maintained entirely in action by air transports of the *Constellation* size.

The one fact that has been proved beyond all dispute in the desperate fighting in the Southwest Pacific has been that air power is the decisive factor. Where we have had air inferiority we have lost. Where we have had air domination we have won. The whole war in the Pacific can be boiled down to terms as simple as that.

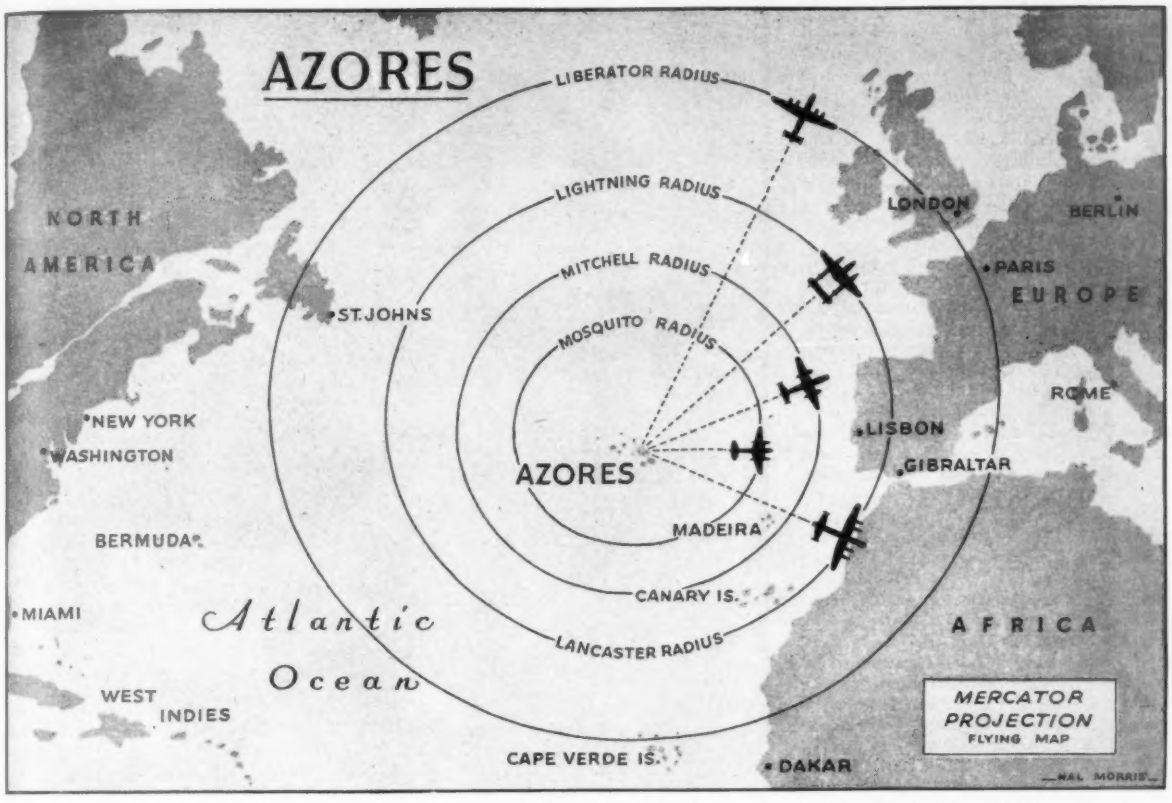
Some of Japan's best brigades of jungle fighters have been completely annihilated because they were denied support from the air against Allied troops which were thrown into action, fed, supplied and maintained entirely by air. Japan, using aviation with consummate skill and cunning in bringing off the great chain of Pacific victories in the first three months after Pearl Harbor, has lagged farther and farther behind ever since.

Japan knows that air domination is the prerequisite to victory, that air inferiority spells slow suffering and inevitable defeat. She has learned a sorry lesson—too late.

Campaigns in New Guinea and the adjacent islands of the Solomons have pushed her aims exactly nowhere, and for this resultless year of fighting she sacrificed something like 420 warships and merchantmen, nearly 3,000 first-line combat aircraft and an estimated 130,000 troops.

Within this broad general pattern of

(*Continued on page* 126)



The Azores—2,400 miles east of New York and 1,260 miles west of Gibraltar—are a valuable anti-submarine patrol base.

ATLANTIC Steppingstone

By JOHN NORRIS

New air bases in Azores aid the war today and pave way for greater aviation use of islands tomorrow.

THE Azores, steppingstone for the first transatlantic flight and refueling station for the New York-to-Lisbon *Clipper* since 1939, may play still another important role in the development of world air transport.

When Prime Minister Winston Churchill announced some weeks ago that Portugal had ceded air and naval base sites in the mid-Atlantic islands to Britain, the move was hailed as a diplomatic victory in the war against the U-boats.

Official statements and press comment emphasized that the bases would enable Allied planes and surface escort and patrol craft to cover the Atlantic sea lanes more thoroughly. Previously there had been a mid-ocean "blind spot" which land-based Allied bombers could not control adequately. Through this area ran the important military supply line from the United States to North Africa, the Venezuela-to-Britain oil tanker route, and the sea lanes from England to South Africa and South America.

Small converted aircraft carriers were starting to fill this gap in our U-boat defenses when the British-Portuguese agreement was negotiated. One result of the action—not mentioned when it was announced—will be to free considerable numbers of these "baby flat-tops" to fight against the Japs in the Pacific.

There will be still another and probably even more far-reaching result of the agreement. Heretofore, the Azores have been a steppingstone for transatlantic seaplane transport only. They were a stopping point for the American Navy NC-4 flying boat which made the first airplane flight across the Atlantic in 1919. Pan American built a *Clipper* base in the islands before inaugurating the first regular North America to Europe airline four and one-half years ago.

For all of their strategic geographical importance to transatlantic air travel, however, the Azores have been a rather unsatisfactory cross-the-ocean steppingstone. The *Clipper* base on Fayal Island there has one bad defect. Landings within the breakwater off the town of Horta often are not possible due to wind conditions and the big flying boats must come down in the open sea outside.

Rough seas prevail throughout the winter in the Azores and even five-foot waves make a seaplane landing dangerous. Often the waves off Horta are as high as 20 feet and *Clippers* are sometimes damaged in coming into the port. On occasion, *Clipper* passengers have been marooned there for a week or more due to sudden rising seas. Once Pan American had to pay the liner *Rex* something like $20,000 to make a special stop and take off its marooned passengers.

As a result, the Pan American planes often do not land there in winter. Eastbound *Clippers*—aided by prevailing winter tail winds—then load up with gas at Bermuda for the 3,100-mile non-stop flight to Lisbon. This means that many fewer passengers can be carried than on

(*Continued on page* 144)

Master these books and the use of these instruments and you have mastered the art of celestial navigation, which is the heart of long-range flying.

The Elements of 'CELESTIAL'

By Lieut. Comm. P. V. H. WEEMS

A famous navigator outlines basic equipment and information necessary for celestial navigation.

AVIATION is a complex art. A skilled transport pilot should have a liberal college education. A thorough ground school and flying course requires another four years. A few more years' instruction in instrument flying, a couple more as co-pilot, and—"hello, here I'm 35 and my eyes are failing!" No time has been allowed for training in celestial navigation. By time-honored methods this instruction would require another year or more.

This perhaps puts too much color in the picture, yet the main features are correct. At the same time, it is abundantly clear that celestial navigation is necessary to future aviation. Our "out" from this dilemma is to so balance the training of our pilots that they may be qualified in their 20's for practical operation of aircraft, including instrument flying and celestial navigation. To do this requires the vigorous elimination of instruction not required in practice.

Some will talk profoundly of "fundamentals," of the necessity to derive formulas and the importance of a knowledge of astronomy. Extra knowledge of any subject does no harm, yet few practical celestial navigators could deduce the formulas they use—nor is it necessary. As for astronomy, it is a science in itself. What we need from astronomy is the ability to identify the sun, moon, four planets and about 55 stars, and to use their positions to find our own.

We therefore select the methods and equipment we prefer and show how to use them with the simplest language we can muster.

The equipment needed includes:

(a) Aircraft sextant, Link averaging type
(b) Accurate watch, preferably with second-setting feature
(c) Air Almanac
(d) H. O. 214
(e) Line of Position Book
(f) Star Altitude Curves
(g) Navigation Note Book and Plotter
(h) Illyne Star Chart

Detailed instructions are furnished with each of these items and should be studied by the student.

Use of equipment:

(a) Instructor will give the students a practical demonstration on how to use the sextant—this, together with the descriptions furnished with the sextant, will enable the student to adjust and operate the instrument.

(b) Any accurate timepiece may be used, but a correction for seconds must be made to an ordinary watch since the second hand cannot be set exactly. Therefore, a second-setting watch set to the exact second of Greenwich civil time is preferable.

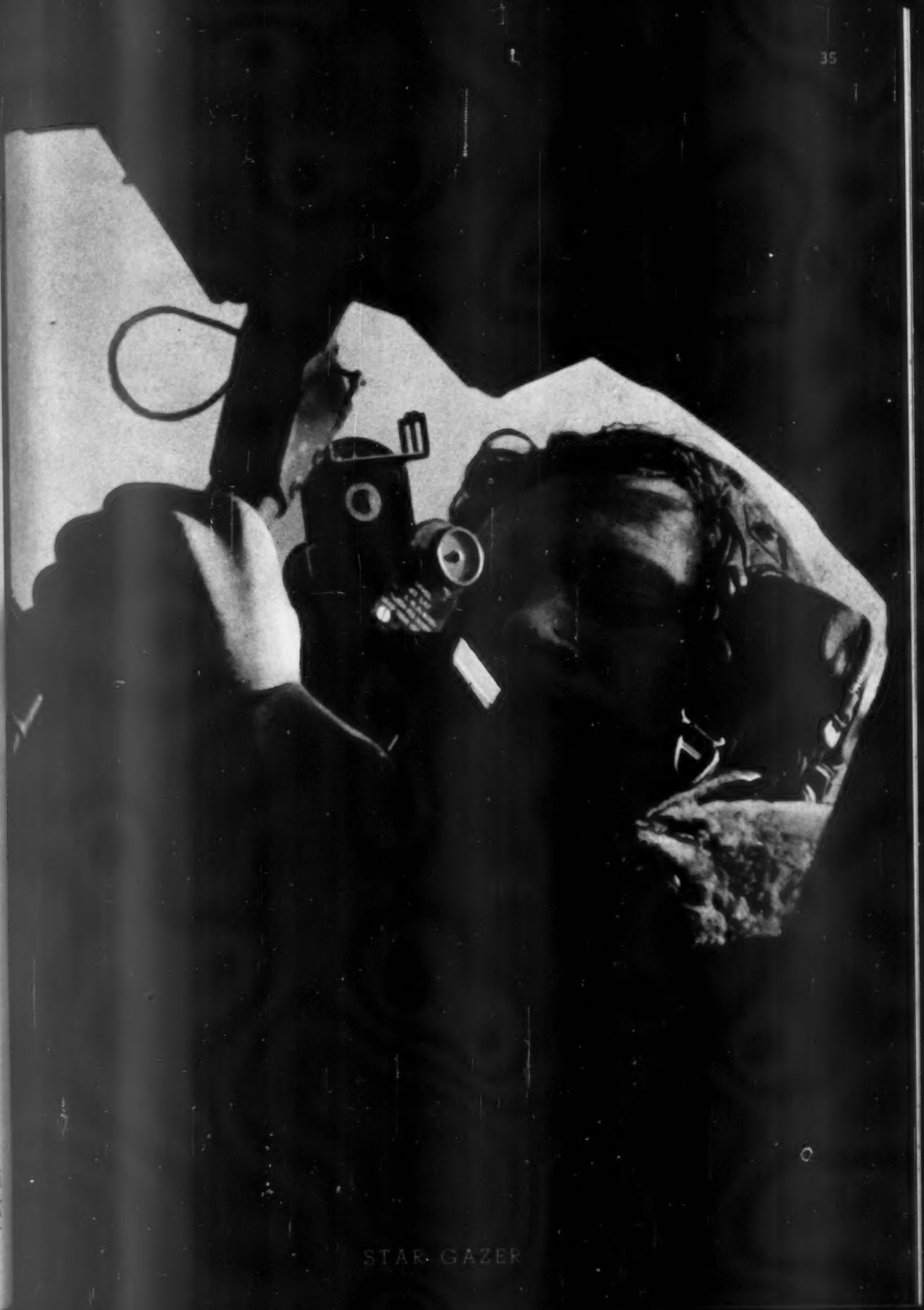
(c) The student should study the text in the Air Almanac and also note the run of the tables. Greenwich hour angle (GHA) and declination (dec. or d) are the data in the almanac most used by the navigator. The GHA and declination of any celestial body determine the latitude and longitude on the earth of a point directly under the body. This is the *geographical position* (G. P.) of the body. The G. P. of the sun, for example, travels west at a speed of 900′ of longitude per hour. The almanac tabulates the G. P. of all navigational bodies at suitable intervals.

(d) H. O. 214 and/or

(e) The Line of Position Book provide the means for converting the data taken from the sextant, watch and almanac into a "line of position." A "line of position" is a line on the earth's surface at some point along which the observer is located at the time of the observation. The intersection of two such "lines of position" will definitely fix the observer's position on the earth. H. O. 214 is the easiest method, but a large volume is required for each 10° band of latitude. With slightly more work, the Line of Position Book of 44 pages provides a standard method for all conditions.

We now proceed to the work of computing and plotting the line of position. At this point the student should read carefully the text in the chosen method, whether H. O. 214 or the Line of Position Book, and he should also study the ar-

(*Continued on page 99*)



STAR GAZER

AVENGER GOING ABOARD

THIRSTY LIGHTNING

BOMBING-UP

TIN FISH

PROWLING MITCHELLS

PROWLING MITCHELLS

DESERT FORTRESS

U.S. ARMY-AT-6C

AVIATION at *West Point*

By Col. GEORGE F. SCHLATTER
Commanding Officer, Stewart Field, N. Y.

Expanded USMA course requires at least five hours of flying for all cadets and 200 hours for cadet flyers.

Cadets wear wings before graduation if they have completed their flying course.

A BASIC-ADVANCED flying school at Stewart Field, West Point, N. Y., now completes the comprehensive education of United States Military Academy cadets in all phases of modern war.

Familiarly known as the "Wings of West Point," Stewart Field still is developing, organizing and constructing, but neither currently nor during its first year has this aviation school given evidence of growing pains.

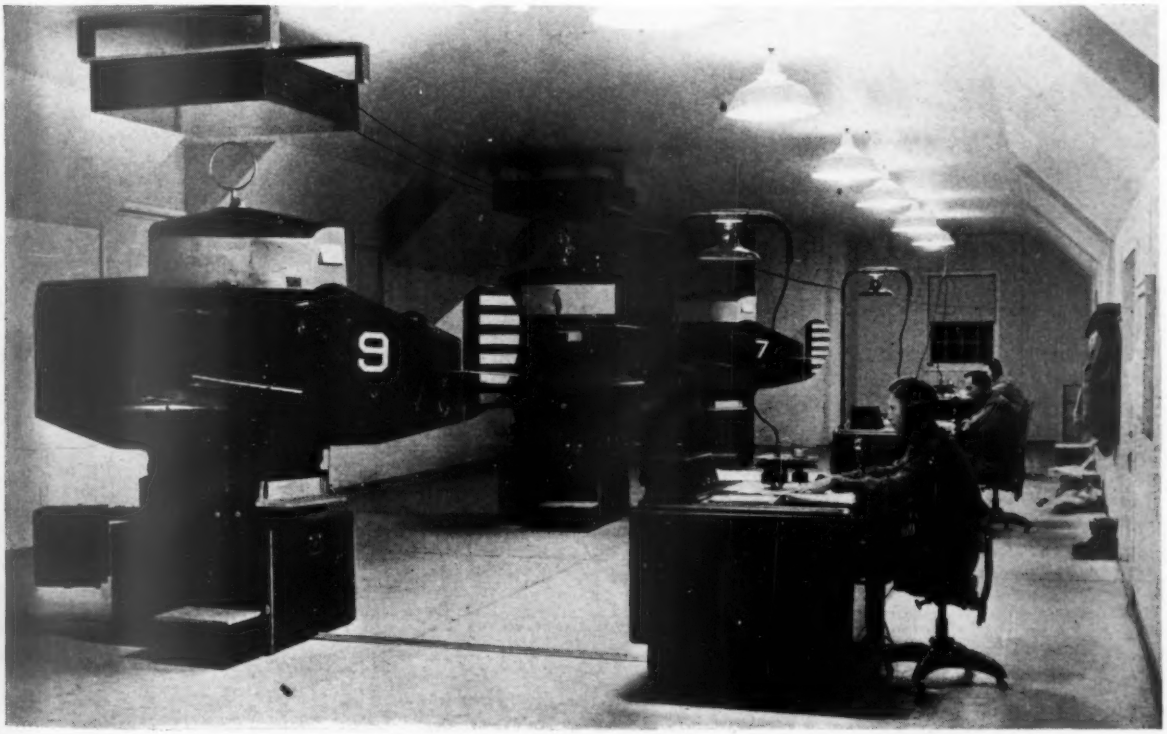
An integral part of the USMA, Stewart Field is located about 15 miles northwest of West Point near the city of Newburgh, N. Y., and occupies acreage formerly included in two local townships.

Where less than two years ago farmers ran their furrows, planted their crops and pruned their fruit trees, the AAF basic-advanced flying school now is turning out flying officers—flying officers not only learned in Air Forces' lore but schooled in every field of warfare embraced by the curriculum of the U.S. Military Academy.

Under its first commandant, Col. John M. Weikert, Stewart Field was virtually completed, and under his successor (the author) the program is expanding and the necessary additional construction rapidly being concluded.

Dedicated on August 25, 1942, while still in the turmoil of excavation, grading and building, Stewart Field went into immediate operation and through all the station's period of growth its primary purpose—that of educating the USMA cadets in aviation—has not been checked or hampered. Flying instruction continues, flying officers are graduated and flying in general has proceeded normally even though contractors' heavy trucks, shovels and graders have been as numerous as planes on the airfield scene.

While the primary purpose of Stewart Field is the air training of West Point students who have been qualified as flying officer material, Stewart Field now has taken additional aviation cadets to its wings. The newly arrived enlisted men are taking twin-engine advanced training.



Typical of the modern facilities at Stewart Field is the Link Trainer division which teaches blind flying to West Pointers.

Cadet T. E. McCabe, South Ordago, N. Y., figures mechanics problem on blackboard.

Larger than New York's LaGuardia Field, Stewart Field will be able to accommodate the largest aircraft flown by the Army Air Forces. The landing area boasts four runzways, three of them being more than 6,000 feet long.

All cadets at West Point are not being educated to become flying officers. Those in the air cadet classes are the men who have elected flying as their specialized field and who have been found physically fit for this training. However, all USMA cadets are required to fly for at least five hours as part of an air observers' course now included in their general curriculum. This flying, of course, is done at Stewart Field.

The cadet flyers, however, follow an especially stiff routine when it is considered that their air training is coupled with the rest of the academic requirements at West Point.

For example, a typical air cadet day includes:

5:50	First call for reveille
6:00	Reveille
6:30- 7:00	Breakfast
7:00- 7:55	Preparing room for daily inspection
7:55- 9:20	Class in military engineering
9:30-10:40	Study period
10:40-12:00	Class in ordnance and gunnery
12:05-12:45	Dinner
1:00- 1:45	Bus to Stewart Field
1:45- 4:00	Flying
4:00- 5:00	Ground school
5:15- 6:00	Bus to West Point
6:20- 6:55	Supper
7:15-10:00	Call to quarters for study periods
10:00	Taps

An alternate afternoon, when not flying, finds the air cadet following this schedule:

1:00- 2:00	Study period
2:00- 3:00	Class in law or economics
3:15- 4:30	Class on unit administration
4:30- 6:20	Free time
6.20- 6:55	Supper
7:15-10:00	Call to quarters for study periods
10:00	Taps

Sixty hours of primary training are first required, and have been given the cadets at various fields throughout the United States, after which they report back to West Point to take up basic training in which 70 hours must be spent in the air. Seventy hours more for the advanced training course completes the 200 hours which the USMA flyers must have logged before receiving their silver wings upon graduation from the academy. The goal is to get in as many flying hours as possible and sometimes the required 200 hours is exceeded.

In its short life and still under its full growth, Stewart Field has already mothered its broods of flyers. Of the 514 offi-

(*Continued on page* 143)

Every moment counts in West Point instruction schedule. Flying cadets utilize spare time to brush up on work.

BUTANE FOR AIRCRAFT

By NELSON M. JONES

Greater power, more safety, no warm-up period are among advantages claimed for this light-weight 100-octane engine fuel.

No stranger to aviation, the author, now research engineer for Green's Fuel, Inc., learned to fly in 1924, did some pioneering in aircraft development. He built a series of planes for private flyers beginning in 1928 and his "J-1" airfoil in 1932 led to the design of a line of aircraft having non-spinning characteristics plus quick take-off, exceptional maneuverability. In 1940 he developed a shipboard observation plane for an Allied government.

RAPID increase in the use of liquefied petroleum gases as fuel for internal combustion engines propelling trucks, tractors, buses and high speed rail trains apparently foreshadows its early adaptation to aircraft. While there has been considerable progress during the past few years in the fields named, surprisingly little consideration has been given to the use of liquefied gases by airplanes, although much experimental work has been accomplished, considerable research work has been done along this line by the author.

Utilization of such fuels in truck, tractor, bus and train operation has been prompted not only by the many direct benefits obtained but also by lowered operating costs. The mechanical advantages, in part, include freedom from carbon deposits in the motor, absence of crankcase dilution and easier starting and acceleration through the more rapid and complete vaporization and uniform distribution characteristics of the fuels. In some instances the exceptionally low carbon monoxide content of the exhaust gases has proved of great value, especially in mine locomotive operation.

The liquefied petroleum gas most commonly used is butane, handled in bulk as a liquid. Butane and other liquefied gases of this group are products obtained through fractional distillation of crude oil and within the same process that produces lubricating oil, Diesel fuel, kerosene, gasoline and natural gas.

The chemical structure of butane is roughly four carbon to 10 hydrogen molecules. The average butane molecule is about one-half the size of a gasoline molecule and in turn is about twice the size of a natural gas molecule. Stated simply, since the larger molecules mean liquids and the smaller ones gases, butane behaves in many ways as if it had a characteristic about half way between gasoline and natural gas.

This is illustrated by the fact that butane has an appearance similar to gasoline when stored in a tank, but in the combustion chamber of an engine it behaves in the same orderly manner as does a natural gas fuel. Such liquefied petroleum gases as butane thereby exist on the border line between liquids and gases and only a slight change of temperature or pressure is required to transform the fuel from one form to another.

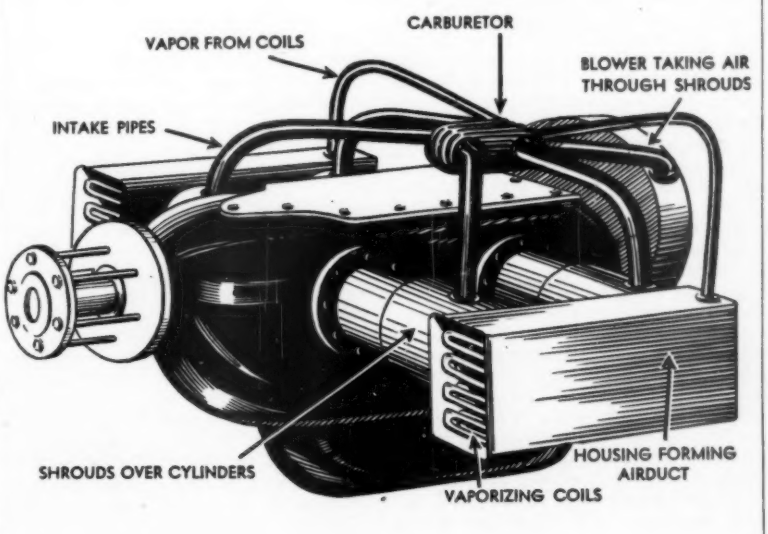
Butane has a normal octane rating of 100 but this rating is easily raised as high as 125 through blending with smaller percentages of other hydrocarbons such as triptane.

Probably the main reason for aircraft engineering disinterest in these fuels is due to a general misunderstanding of their basic characteristics. The aviation industry seems to have two main objections to liquefied petroleum gases: (1) high vapor pressures within the fuel tank creating a necessity for the use of heavier storage containers, and (2) the fixed opinion that these liquids will freeze in altitude cold. The term "freeze" is a much misused term in the liquefied gas industry and does not mean freezing of the liquid into a solid, but rather the loss of vapor pressure due to atmospheric cold, or by cold generated within the liquid by reason of rapid vaporization. Such loss of vapor pressure would be an advantage in aircraft because it would prevent excessive leakage from a punctured tank and would permit the continued use of the conventional self-sealing tank coverings to probably even greater advantage.

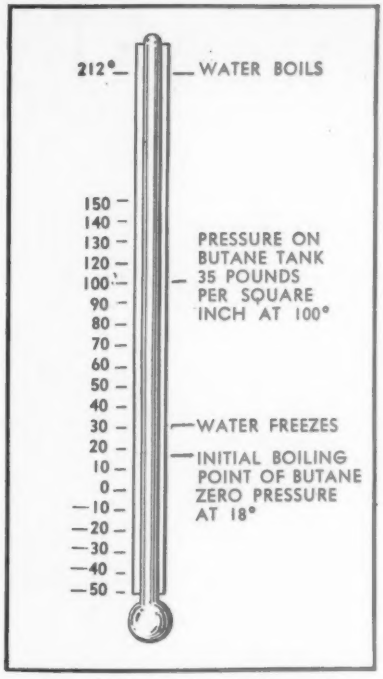
Light weight of the tank structure is possible through the employment of high-tensile steel, fabricated by shotwelding. Considerable thought has been given to this type of tank—particularly the use of spherical containers of reasonable size—which could be fitted easily into various parts of the aircraft structure. Such tanks could be linked together and filled as one unit for quick refueling. Excess flow valves between tanks would prevent fuel loss from tanks adjacent to a punctured tank, or damage to the connecting plumbing.

As an example of the tankage possible by this means, an 18-inch sphere would contain 13 gallons and a 20-inch sphere 18 gallons. Light weight cylindrical tanks of corrugated steel construction could also be used.

It should be understood that butane tanks do not have to be vented to the air since as the butane liquid is withdrawn from the tank, vapor from the remaining liquid fills the space above the liquid and, subject to temperature conditions, creates the necessary vapor pressure. This does not happen when using gasoline and such tanks must be vented, allowing air to enter through the vent and mix with the gasoline vapors forming an explosive mixture. As no air enters or is present in a butane tank after it is initially filled, there can be no explosion



Butane-fueled engine would use refrigeration generated by vaporization of the fuel.



Butane boils at 18°, at 100° generates pressure of 35 pounds per square inch.

of butane within the tank—thus providing an excellent safety factor.

Since liquefied gas fuels are handled and stored in closed containers, contamination by dirt and water becomes a minor consideration. Being closed to the atmosphere, such containers also are free from moisture condensation. Transfer of liquid butane from a tank truck to a fuel tank is done by pumping through a hose similar to handling gasoline.

Butane, having a vapor pressure of 30 to 35 pounds per square inch at ordinary ground level temperatures, does require stronger tanks than gasoline, but, with properly engineered tanks, this is more than compensated for by the lighter weight per gallon of butane (4.84 pounds per gallon against six pounds for gasoline), and by the lighter weight per horsepower made possible through the use of higher compression ratios.

Because of its slow-burning characteristics, butane produces a long explosion period, similar to the action in a Diesel engine cylinder. Due to the high octane rating and slow expansion plus its ability to resist detonation, compression ratios as high as 12 to 1 are feasible and compression pressures as high as 300 pounds per square inch quite practical. Tests on raised compression engines have shown a power increase of over 75 percent for the same cylinder bore and stroke. Because of the easy action of this fuel on engine parts and bearings, an increase of probably 10 percent in engine parts weight should provide for a power increase of 50 percent or more. With butane, the power increase is well spread over the r.p.m. range.

Contrary to common belief, raising the compression ratio of an engine does not necessarily increase the bearing loads. Actually, the average bearing loads can be materially reduced by an increase in compression ratio. This is caused by the fact that inertia forces are almost invariably larger than those due to gas pressure. The increase in compression ratios from 5.5 to 7 to 1 in a Wright *Cyclone* engine reduced the master rod crankpin bearing pressures from 17,600 pounds to 16,300 pounds, or 7.38 per cent.

Freedom of this fuel from carbon-forming tendencies is a great aid in utilizing such higher compression ratios. Gasoline and gasoline-lead fuels invariably form an accumulation of carbon, carbon gum and lead compounds over the surface of the combustion chamber, which in turn forms a coating of low thermal conductivity that increases surface temperatures, reduces volumetric efficiency, and promotes detonation and self-ignition of the fuel. Engines that have been run on butane can be stored indefinitely without danger of internal corrosion or sticking of parts such as rings and valve stems. This is one of the reasons why the auto industry has used butane and butane mixtures for breaking-in new engines.

The gas obtained through vaporization of liquid butane is dry and mixes completely with air, there being absolutely no condensation or droplets of fuel within the engine manifold as is the case with gasoline. Neither is there any tendency toward stratification within a properly designed manifold. Since no manifold heat is necessary or desirable with butane, this makes possible instant and positive acceleration even though the engine is cold. The author has made numerous manifold tests along this line, using a test engine connected with a General Electric Hydraulic Dynamometer.

There is also no tendency of this fuel to vaporlock in the lines and this, with its acceleration properties, is of particular value in aircraft maneuvering.

Because the butane gas is dry, and inasmuch as the modern military airplane has a thermostatic oil warm-up control, the author believes that butane would be of particular value as a fuel for pursuit aircraft because of its ability to permit an instantaneous take-off without the usual lengthy warm-up period, and would eliminate the periodic warm-ups of stand-by pursuit aircraft.

The carburetor used with butane is not a true carburetor in the gasoline engine sense but is essentially a gas-air mixing valve. Since the fuel reaches this mixing valve in a completely gaseous state, no float chamber, float and needle valve are needed as in a gasoline carburetor. This eliminates at one stroke a major source of trouble and fire hazard, bad enough in ordinary automotive applications but of vital importance from an aeronautical standpoint.

Such a mixing valve consists basically of a suitable light casting incorporating a throttle valve below a venturi throat through which the air is introduced by suction or blower pressure. Arranged around and communicating with this venturi throat are a number of simple jets through which the dry butane vapor is introduced into this air stream to form the explosive mixture.

It is obvious that the dry vapor will not have even the remotest tendency to stop up these jets, particularly those of a size that would be used in a large aircraft engine. The orifice of a typical jet would be of approximately $\frac{3}{16}$-inch clear diameter. Again this eliminates another source of trouble as contrasted with gasoline carburetion. In addition altitude compensation for proper mixture would be simple as compared with gasoline carburetion and would be essentially an altitude differential-operated gas pressure regulator. An economizer is generally a part of such a mixing valve and is a simple, vacuum-operated, gas metering valve. Low speed control is generally a by-pass gasjet coming into action at part-throttle opening.

The complicated carburetor for gasoline operation of a large aircraft engine will cost in the neighborhood of $1,500. The mixing valve for operating the same sized engine on butane in all probability would cost not more than $150. Because no liquid is handled through the mixing valve, as far as carburetion is concerned the engine will run at full power upside down or in any position indefinitely. On some automotive applications, a device known as a heat exchanger is used as an adjunct to the mixing valve for the purpose of converting the butane liquid into gaseous form, in which process heat from the liquid cooling system is utilized.

Another method of accomplishing this conversion is to utilize the cold that is always produced when a liquid is changed into a gaseous state. This is the basic principle of commercial refrigeration. A hardly considered phenomenon of liquefied petroleum gases is the refrigerative properties obtained when they change from liquid to gaseous form. A butane gas, for instance, was once used as the refrigerant in a make of domestic refrigerators.

This opens up an important avenue for future development. Consider, for example, an aircraft engine of the general type of the Allison, and suppose we increase the horsepower one-third by raising the compression ratio much more than the present accepted standard, this being possible through the use of butane or a mixture of butane and other liquefied petroleum gases as fuel. The increase in weight for additional strength of parts would be about 8 percent engine weight. This engine, as pointed out, would run approximately 10 percent cooler through this change alone.

Now let us consider the refrigeration generated by the vaporization of the large volume of butane fuel burned by such an engine. The fuel consumption will run about the same as gasoline—let us say, for example, 150 gallons per horsepower hour for this 1,700 h.p. engine. The cold produced through vaporization of this amount of fuel would be equal to the heat absorption of approximately 850 pounds of ice completely melting in an hour. This refrigerative effect could be used in a booster cooling system as an adjunct to the main method of cooling, or might serve alone to cool the engine in future developments.

This is a feature worth consideration in

(*Continued on page* 156)

THE CAB GRAB-BAG

By JO ELLEN ADAMS

From screwballs and seasoned operators, hundreds of applications for post-war routes shower on Washington.

BACK in 1938 about this time the Civil Aeronautics Board had before it 137 pending applications for airline routes. Since then, more than 1,100 have been filed, 648 have been disposed of and more than 348 are pending.

Add to these figures the fact that the aviation boom now going on in Washington has all the appearances of a short-circuited pinball machine and you have, surprisingly enough, a consensus of what the CAB thinks—unofficially—of the situation.

The pinball motif haunts the Board daily. Typical is the case of a couple of District of Columbia operators, one of whom applied recently for all the helicopter privileges from Maine to Maryland. The other wanted similar rights from Maryland to Florida. The Board wrote Maine-to-Maryland, asking him if he were in cahoots with Maryland-Florida. They got a prompt answer that they were to pay no attention to the guy, he was a phoney—he sat across the aisle from Maine-to-Maryland at Woodrow Wilson high school and was just trying to muscle in on a bright idea!

Young amateurs are rivalled by old ones. An undertaker wants to start a flying ambulance and funeral service, stating that "there is considerable need for such a service." Filene's, a Boston department store, has applied for a gyro delivery permit. A third applicant seeks a grant for an aerial sightseeing service in the Grand Canyon.

Still another forward-looking citizen has pinned his hopes on an application for a certificate authorizing him to establish an air service for baby chicks with a few passengers thrown in.

There was a time when the members and staff of the CAB looked upon such applicants with amused tolerance, but today Board personnel has been known to wish wistfully that youthful airline aspirants be classified as juvenile delinquents. Fun is fun, but the Board has a job of work to do that is taxing it to the limit. One of the smallest agencies in Washington, and operating on a budget approximating only a million dollars, the organization is understaffed with but 322 persons and is threatened with additional personnel cuts by the manpower shortage and the draft. Lawyers simply cannot be had. Of all the executives in the vast Department of Commerce building, Chairman L. Welch Pogue is the most familiar to the night watchmen. He seldom leaves his desk before 10 p.m.

Board spokesmen cite a few fundamentals underlining the futility of such applications as those cited above. The records show that an applicant has no chance of success unless, aeronautically and financially, he is capable of swinging his franchise once it is granted. It is estimated that more than 50 per cent of the applications now before the Board will be eliminated for one or another of these reasons. There's a war on and a plane shortage. Furthermore, with President Roosevelt favoring permanent certificates for lines to operate in the Caribbean and South America, domestic applications now cooking must be pushed far back on the cold end of the stove.

Further analysis of the current situation indicates that, once you get behind the freak cases and the phonies, things are not in a hopeless scramble. A total of 348 applications are now pending, but the number of companies or individuals that have presented them total only 156. Cut out the 50 per cent of incapables, and you have some 75 or 80 sound requests under consideration.

The Board has tried to streamline the

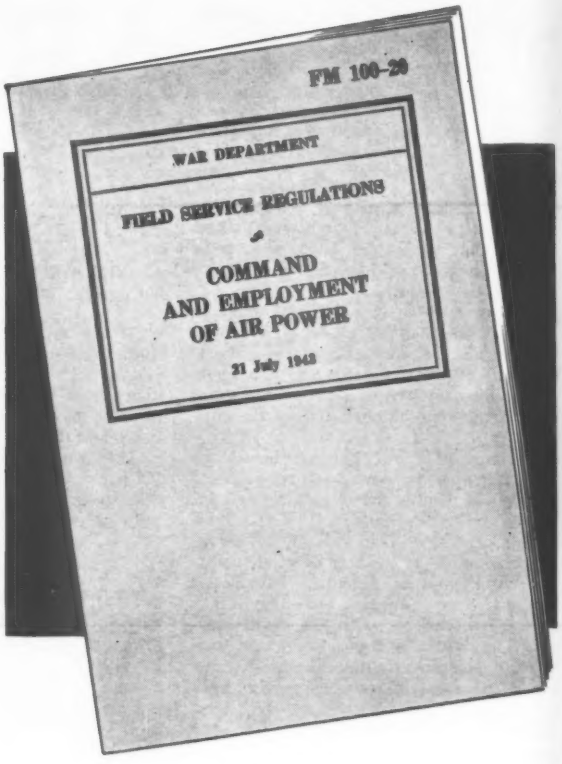
(*Continued on page* 114)

Typical of applications from experienced airlines is this for an Asiatic route.

AIR POWER CONTROL

By JOHN C. ROSS

Interdependence of ground and air forces is strongly stressed in new field manual.



THE principles of the employment, command and organization of the U. S. Army Air Forces are set forth in new field regulations on "Command and Employment of Air Power," which have been approved and published by the War Department. The regulations describe the basic tasks of the air force and its components and indicate, too, that the AAF has become a separate air force in virtually all but name.

Like the preamble to a constitution, for example, the first clause in the regulation asserts that "land power and air power are co-equal and interdependent forces; neither is an auxiliary of the other."

Explaining the principles under which the AAF is to be used, the regulations declare that "the gaining of air superiority is the first requirement for the success of any major land operation. . . . Therefore, air forces must be employed primarily against the enemy's air forces until air superiority is obtained." Only in this way can air attacks against land forces be countered and the inherent mobility of modern land and air forces be fully exploited.

"The inherent flexibility of air power is its greatest asset. This flexibility makes it possible to employ the whole weight of the available air power against selected areas in turn; such concentrated use of the air striking force is a battle-winning factor of the first importance."

"Therefore, control of all available air power must be centralized. Command must be exercised through the Air Force commander. In a theater of operations command is organized as follows:

"Command of air and ground forces . . . will be vested in the superior commander charged with the actual conduct of operations in the theater, who will exercise command of air forces through the Air Force commander and command of ground forces through the ground force commander. The superior commander will not attach Army air forces to units of the ground forces under his command except when such ground force units are operating independently or are isolated by distance or lack of communication."

U. S. military aviation is organized into two general categories: (1) that under the command and control of the commanding general AAF, and (2) that assigned to theater or task force commanders. The former includes training, research development, test, procurement, storage, issue, maintenance, transport and such tactical units as are not assigned to the theater or task force commander. The commanding general also has such control of theater or task force action as is necessary for the control, supervision of training, and the supply and maintenance of AAF equipment.

There is normally but one air force in a theater of operations. No set organization is prescribed but its normal composition includes a *strategic air force*, a *tactical air force*, an *air defense command* and an *air service command*. An air force may also include troop carrier and photographic aviation.

A highly flexible organization exists within tactical units based upon the following order of groupings:

1. The *flight* is the basic tactical grouping or unit of the AAF and consists of two or more airplanes.

2. The *squadron* is the basic administrative and tactical unit and consists of three or four flights.

3. The *group*, composed of three or more squadrons, is both tactical and administrative. It contains all the elements essential for its air operations.

Ordinarily the group is the largest unit of the AAF that will operate in the air as a tactical entity under the command of one individual. Many air operations are conducted by smaller units. Reconnaissance and photographic missions, and less frequently bombardment missions, may be carried out by single airplanes with the required fighter cover.

4. The *wing* is the next higher unit of the Army Air Forces and its functions are primarily tactical.

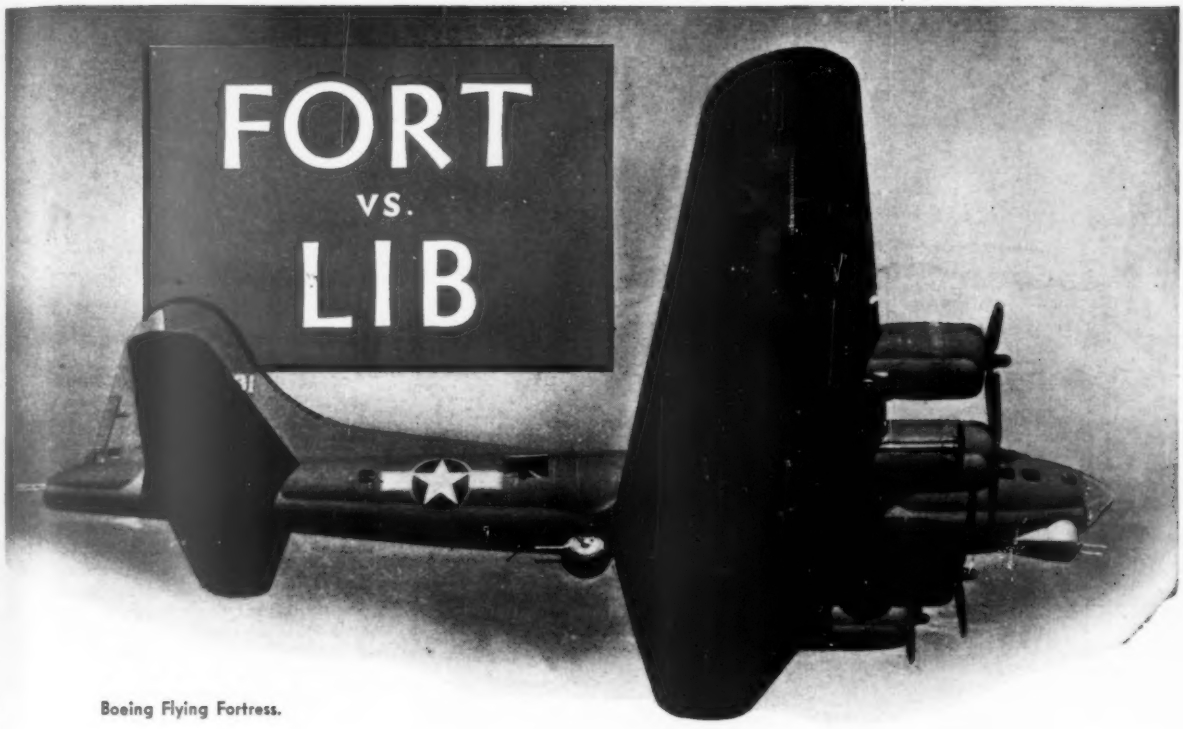
5. Two or more wings may be combined to form an *air division*.

6. An *air command* may include divisions, wings, groups, service and auxiliary units and is both tactical and administrative.

7. The *air force* is the largest tactical unit of the AAF. It requires aviation engineer units for the construction and maintenance of bases.

The basic tasks of the air force are conceived to be (a) to destroy hostile air forces, (b) to prevent the establish-

(*Continued on page* 162)



Boeing Flying Fortress.

In the January issue Mr. Masefield named the Liberator as being slightly superior to the Flying Fortress in the heavy day bomber category. So many readers rose in defense of the Boeing bomber, we cabled him for this clarification of his choice.

FORT vs. LIB

by PETER G. MASEFIELD

The author started a controversy last month in naming the Liberator as superior to the Flying Fortress.

WHEN the history of these times comes to be set down, there can be no doubt that written large across the chapters of achievement of the many great combat aircraft will be the deeds and daring of the Boeing *Flying Fortress* and the Consolidated *Liberator* day bombers. Both have done, and are doing, magnificent work the world over. With the British night bombers—the *Lancaster*, the *Halifax* and the *Stirling*—both will live in history for their great contribution to final victory.

Of the two—the B-17 and the B-24—which is the outstanding heavy bomber of its day? Such is a difficult, and indeed a delicate, question to be covered in one short answer. Many provisos must be taken into account. Having attempted the "short answer" recently in a selection of what I believe are mathematically and from experience the best aircraft in the world in different specialized categories, some detailed discussion of the reasons for the choice may not be out of place in fairness to the two fine aircraft.

Six months ago there was not the slightest doubt that the B-17F *(Fortress)* was a superior day bomber to the, then, B-24E *(Liberator)* for all-round operation against a powerfully-defended enemy.

(*Continued on page* 168)

Consolidated Liberator.

MINIATURE AIR FORCE

The armed forces use millions of model planes to teach aircraft identification. Here, West Point cadets study suspended Liberator.

WHILE aircraft manufacturers dream of thousands of airplanes or at most tens of thousands, there is one manufacturer who has dreamed of millions—and built them! That they are model planes does not detract from the unique part they play in helping to win the war.

Since the spring of 1941, the Cruver Manufacturing Company of Chicago has manufactured nearly 2,000,000 model aircraft of cellulose acetate plastic, perfect replicas in every external detail of their original prototypes on a common scale of one inch to 72 inches. As this was written they included 199 different types, including 35 U. S. Army and Navy models. The rest are British, Russian and Axis.

While the models have been made available to war plants in a few instances where the Cruver management is convinced they can do a job of helping employee instruction, by far the largest purchasers have been the Army and Navy, which use them for two training purposes.

First, the models are used for aircraft recognition. They are extremely accurate as to dimensions and shapes and in placement and size of detail. So accurate and fine is this detail that, placed against a cloud background and photographed, the models can scarcely be distinguished from the full-sized planes they represent—and in fact, they have been used for just such photographic purposes.

Second, they have been used for range estimation, a combination of plane recognition and gunnery. Gunners must know not only the appearance of friendly and enemy planes but the size of each so they can tell by the amount of plane seen in the ring gunsight whether it is within range, how much to lead it and when to fire. Model planes of a common scale and great accuracy in shape are placed in the dummy ringsights to teach gunnery students the combination of instantaneous

By CURTIS FULLER

Millions of die-cast plastic models are in use by our armed forces as recognition and gunnery aids.

recognition and range estimation which, as combat gunners, they will have to know.

Model planes have another supreme advantage over silhouettes in teaching aircraft recognition. The students can pick the models up, handle them, learn where the details are, feel them. For all practical purposes they are not handling models but the actual planes. They not only have visual recognition but tactual recognition. They see with their eyes and feel with their hands that the trim tab is set in the left wing of the *Flying Fortress*, that the *Lightning* has a longer nose, different wing shape, different tail boom than the somewhat similar Focke-Wulf Fw-189; that the original P-40 differs from the P-40E.

The Cruver company began to manufacture plastic model planes in May, 1941, after Charles C. Livingston, Cruver's vice president and general manager, saw the advantages of plastic models to replace less satisfactory materials then in general use. Mr. Livingston is a fast-working executive. In his spare time he manages to crowd in work as chairman of the post-war planning committee of the plastics industry and as a member of the plastics advisory committee of both WPB and OPA. Today his is the only company making these scale models from plastic.

There developed a crying need for standardized accurate model planes for aircraft recognition when the Army and Navy began to expand their air forces. One attempt to get models took the form of an appeal to an army of schoolboy model plane builders. While this appeal resulted in some fine individual models made by the young enthusiasts, it also ended in a lack of standardization of size and shape which defeated its original purpose.

"These planes were often fine individually but it was inevitable that they would reflect the personality of their builders," Mr. Livingston

(*Continued on page* 136)

The Navy uses model planes too. Chief petty officer points out features of Cant Z-506B. "Escorting fighters" are Fiats and Macchi C-200.

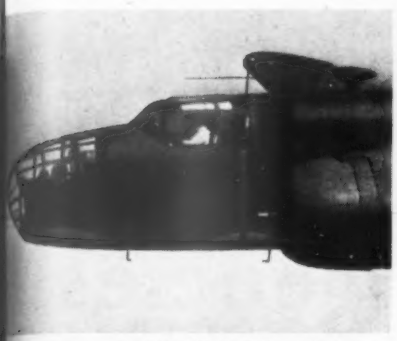
Automatic molding machines turn out model planes (here Savoia Marchetti SM-84's) to meet mass-production needs of armed forces.

Two .50-cal. machine guns above the Mitchell's cannon are used to spray antiaircraft gunners as plane is aimed for cannon shot. These guns' bullets pierce armor.

Army officer and factory employee illustrate size of the 20-pound, 75-mm. shell.

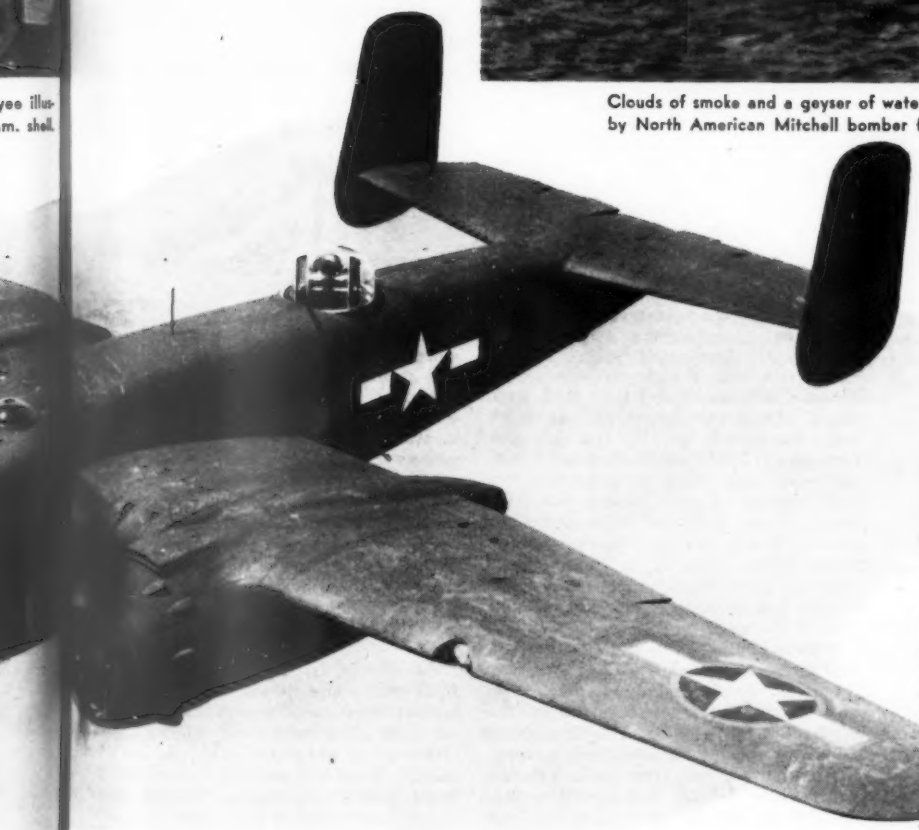
BIG SHOT

A FEW years ago aviation ordnance technicians conducted a number of tests with plane-mounted 75-mm. cannon, none of them too successful. One such gun was mounted in a Douglas *Bolo* (B-18A) for aerial firing tests; the pilots brought back some hair-raising reports of what took place. Greatest difficulty was in absorbing the recoil. First practical solution to this problem is the *Mitchell* shown on this and the opposite page. The entire installation adds 2,000 pounds to the *Mitchell's* gross weight. Each shell (exact number carried per plane still is secret) weighs 20 pounds and is 23 inches long. One can shoot through both sides of a medium tank or knock out an antiaircraft battery. Prior to this version of the *Mitchell*, the largest aircraft cannon was the 40-mm. gun on Britain's *Hurricane IID*.



The cannon-mounted Mitchell has shorter nose than conventional Mitchell (above), revised navigator's compartment, relocated controls and armor plate on frontal area.

Clouds of smoke and a geyser of water mark attack on Japanese destroyer by North American Mitchell bomber firing 75-mm. shells in South Pacific.



Cannon-mounted Mitchell medium bomber retains former bomb capacity, speed and armament of .50-caliber machine guns although 2,000 pounds have been added to its weight.

ARCTIC Emergencies

The widespread operations of the Army Air Forces over such varied terrain as tropical jungle, snow-capped mountains, deserts, and Arctic regions has given rise to a number of lively, intelligible and authoritative booklets designed to assist airmen forced down in these unfamiliar zones. The following article is, in large part, a reprint from one of these booklets, written for airmen flying over the Arctic. The booklet was prepared by the Safety Education Section, Flight Control Command, AAF. It has a buttoned-over cover to protect contents and make it convenient for all flyers to carry. It is profusely illustrated with drawings of signals, means of making life easier, edible plants, and animals likely to be met.—Editor.

☆

THE Arctic is not always ice, snow and cold. In late August, 80 per cent of all land north of the Arctic Circle is free of snow. Summer temperatures in the lowlands, remote from mountain and seacoast, run around 85° to 90°.

Arctic winter climate on the average is dry. Actually, relatively little snow falls. What appears to be a blizzard is frequently merely old snow being blown from one point to another by a high wind. Annual snowfall added to annual rainfall seldom exceeds 10 inches. Heaviest snows come in the spring.

When an emergency develops over the Arctic, *land your plane* if it is at all possible. Crash landings or even wheels-down landings can be executed with safety on snow. Landings on ice should be made wheels-up.

Don't wander aimlessly if you are lost. Save enough gasoline for a landing under full control with enough extra for an exploratory approach to your landing spot. Watch for blowing snow—it will indicate the direction of the ground wind.

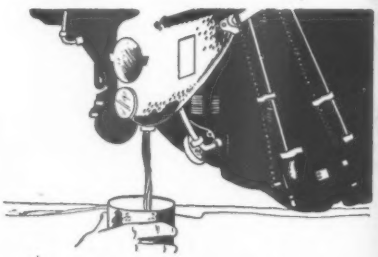
Don't pick an area of ice or snow that looks patchy from an altitude. It may be deeply drifted snow or rough crevassed ice. Tightly packed snow drifts, known as sastrugi, look like ocean waves from an altitude. If a landing must be made on such terrain, land parallel with the drifts.

In searching for a good landing spot make use of the natural "sky map." It will save time. In the Arctic, a uniform overcast with clouds at a high level reflects the terrain below and gives a fairly dependable indication of terrain and general ground conditions. A uniform white "sky," for example, indicates a uniform covering of snow. If the "map" is mottled, the region directly below is likely to be pack ice or drifted snow. Blue (new) ice is indicated by grayish patches, and open water, timber, and snow-free ground show up as black areas in the cloud reflection.

Bail out over the Arctic only in an extreme emergency and then stuff your maps, emergency rations and as much loose equipment as you can in your pockets and inside your flying coat. Landing with your plane is important not only because it will provide you with shelter, food, fuel and equipment, but because it will serve as a marker for the planes that are sent out in search of you. Men are hard to see on the snow even from a low altitude; a plane stands out against the snow.

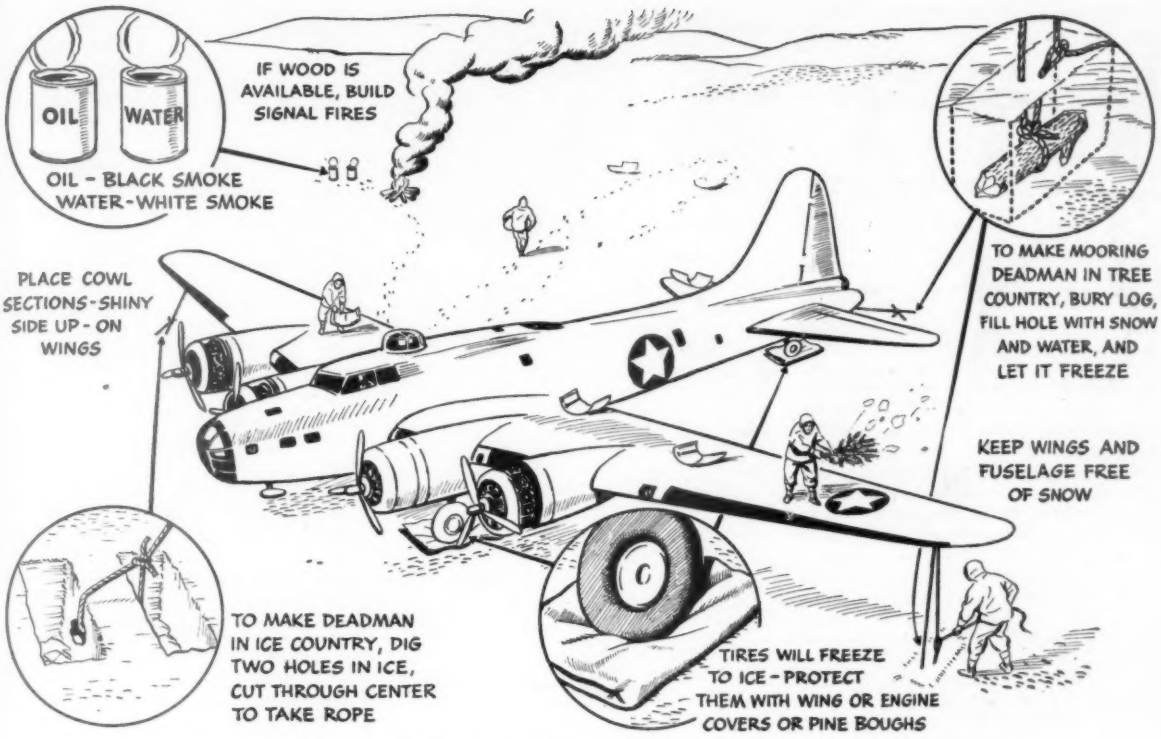
If your landing is in snow country do two things immediately:

1. Drain several gallons of lubricating oil from the engine oil sump. In the far north this oil will be your immediate source of fuel for heating and cooking. If you wait too long after landing the oil will become so stiff that it will be impossible to drain it. A cowl section can be used as a receptacle. Drain a similar quantity of gasoline but, if it is wintertime, *don't spill any on your hands*—it will freeze.



2. If you were successful in making a wheels-down landing and your plane is still flyable, drain *all* the lubricating oil (it will be simpler to heat the congealed oil than to heat the engine if a take-off is attempted) and stake your plane to protect it from the wind. In snow country, mooring anchors can be made by burying branches, sacks, boxes, or cans in the snow and pouring water over the spot. On ice, two holes can be dug a foot apart and a hole chopped through the intervening bridge to take the mooring line. Mooring lines should be tight enough to prevent the plane from rocking.

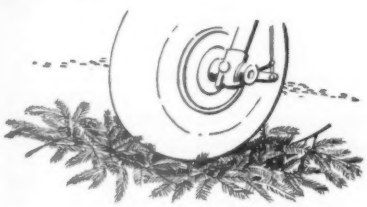
For signals, remove all snow and frost from your plane—it will stand out better against the snow. Remove the cowl panels from your engine (or engines) and place them, unpainted side up, on the wings. They will serve as reflectors. If wood is available, lay up several large signal fires about 50 feet from each side of the plane. Lubricating oil thrown on


OIL
WATER
OIL - BLACK SMOKE
WATER - WHITE SMOKE
IF WOOD IS AVAILABLE, BUILD SIGNAL FIRES
PLACE COWL SECTIONS - SHINY SIDE UP - ON WINGS
TO MAKE MOORING DEADMAN IN TREE COUNTRY, BURY LOG, FILL HOLE WITH SNOW AND WATER, AND LET IT FREEZE
KEEP WINGS AND FUSELAGE FREE OF SNOW
TO MAKE DEADMAN IN ICE COUNTRY, DIG TWO HOLES IN ICE, CUT THROUGH CENTER TO TAKE ROPE
TIRES WILL FREEZE TO ICE - PROTECT THEM WITH WING OR ENGINE COVERS OR PINE BOUGHS

Elaborating on the booklet, one of the illustrations shows stranded airmen what to do in the vicinity of their plane.

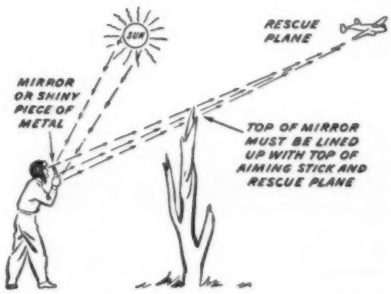
a fire will make a smudge visible for a good many miles. In snow country where there are trees, distress messages can be written in the snow by forming 200-foot-high letters with evergreen boughs. Keep your signal pistol or signal flares where you can get them quickly.

Some measure should also be taken to prevent your landing wheel tires from freezing to the ice. A padding of boughs, canvas, or straw under the wheels will do the job.

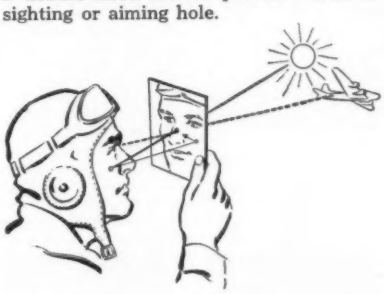


When the sun is shining, a mirror or any piece of shiny metal is salvaged from your plane can be used as one of the best of all signalling devices. One of the simplest ways to aim a mirror is to use an aiming stake. Any piece of wood four or five feet long can serve as the stake, or one of your party can stand in position.

Hold the mirror so you can sight along its upper edge. Change your position until the tip end of the stick and the plane line up. Then adjust the angle of the mirror until the beam of light reflected by the mirror hits the top of the stick. If stick and plane are then kept in the sighting line, the reflection will be visible from the plane.



Some emergency kits are now fitted with a special signalling mirror, which is a double-faced mirror provided with a sighting or aiming hole.



Hold the mirror a few inches away from your eye and sight at the plane through the sighting hole. The light from the sun shining through the hole will form a light spot on your face, and this spot will be reflected in the rear surface of the mirror. Then, still sighting on the plane, adjust the angle of the mirror so the light spot on the rear mirrored surface just coincides with the sighting hole. When it does, the mirror will be accurately aimed.

Once you have sighted a rescue plane and attracted the attention of the pilot, body signals can be used to transmit messages.

As soon as possible after landing, check your equipment. Snow goggles should be worn at all times. The snow goggles in your kit will protect your eyes against the glare. If they have been lost or broken you can fashion a pair of Eskimo-type snow shields from a scrap of wood about six inches long and an inch wide by burning holes or slits through it at eye width. The goggles can be held on with a short length of shroud line cut from your parachute. Don't make your snow goggles out of metal. Metals will freeze to your skin.

As an additional precaution against snow blindness, blacken your cheeks and the bridge of your nose with soot, charcoal, or dirty engine oil. The blackening will help cut down reflection.

Snow blindness can occur during a

BODY SIGNALS

All O K
Do Not Wait

Can Proceed Shortly
Wait If Practicable

Need Mechanical Help
or Parts—Long Delay

Our Receiver
Is Operating

Use Drop
Message

Affirmative
(Yes)

Pick Us Up—
Plane Abandoned

Do Not Attempt
To Land Here

Land Here (Point in
Direction of Landing)

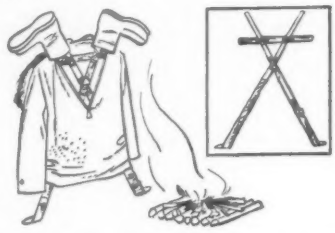
Negative (No)

Need Medical Assistance
URGENT

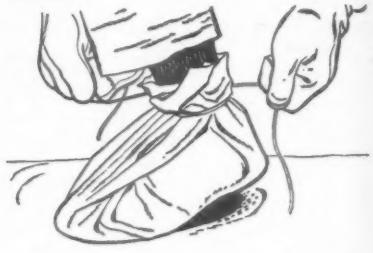
bright overcast as quickly as during sunny weather.

Several layers of light clothing are much warmer than a single layer of heavy clothing. Inner clothing should be fluffy and porous; outer clothing should be windproof.

In winter your clothes should be loose enough to allow a free circulation of air so that your perspiration can evaporate. If it doesn't it will form frost inside your clothes and you will be well on your way to freezing and frostbite. Keep your clothes and your socks dry. If you must do heavy work, loosen your clothing and remove some of it. Avoid becoming overheated—an excess of perspiration will mean wet clothing and drying them in sub-zero weather is difficult. If you get wet change to dry clothing as soon as possible. Frost can be removed by turning the garment inside out and beating it with a stick. To dry clothes with the heat from a fire build a simple rack to hold them.

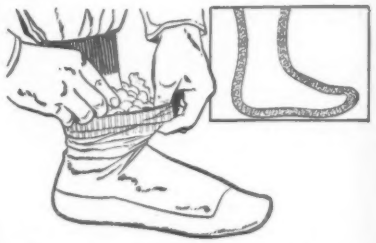


Don't wear tight shoes. If the shoes you have on are not big enough to allow you to wear at least two pair of heavy socks don't use them. Instead, improvise a pair of boots by wrapping your feet in strips of canvas cut from your wing covers, motor covers, or any other heavy material that may be aboard your plane. If rescue fails your feet will be your only means of travel, so take care of them.



Keep your hands and feet warm and dry and you will be fairly comfortable no matter what the temperature.

An improvised warm double sock can be made by putting one pair of wool socks inside another and inserting a layer of stuffing from a life preserver cushion into the space between the two.



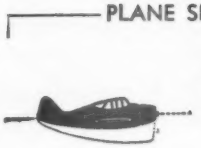
If you have them, a good combination for keeping your hands warm consists of heavy woolen inner mitts with canvas or other windproof outer mitts.

Never touch cold metal with your bare hands. It will freeze to the skin. If you do touch metal by accident, *thaw* the metal loose from the skin. Don't pull it.

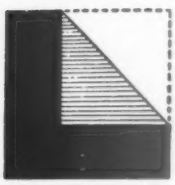
Tight-fitting face masks made of canvas or other cloth should be avoided. They are more of a hazard than a protection. Instead, fasten a piece of cloth across the front of your parka hood just below the level of your eyes and let it hang down loosely below your collar. This type of face shield not only protects your face but allows your moist breath to escape.

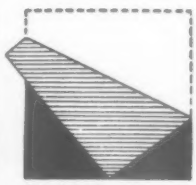
(*Continued on page* 101)

PLANE SIGNALS


Affirmative (Yes)

Negative (No)


Need Gasoline and Oil
Plane Is Flyable


Need Tools
Plane Is Flyable

Need First-Aid
Supplies

Need Quinine
or Atabrine

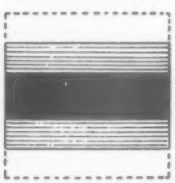
Need Medical
Attention

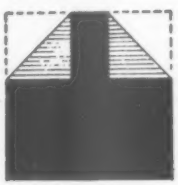
O K to Land—Arrow
Shows Landing Direction

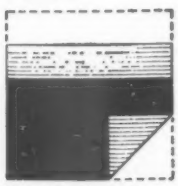
Should We Wait
For Rescue Plane?

Need Food
and Water

Do Not Attempt
Landing

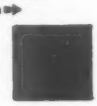

Indicate Direction of
Nearest Civilization


Need Warm
Clothing


Have Abandoned Plane,
Walking in this
Direction ➡

If you are equipped with the basic parachute pack kit, or life raft kit, make use of the blue and yellow signal panel.

Yellow

Blue 

Even the nobles are Short-Snorters. Lord Louis Mountbatten, commander-in-chief of Southeast Asia war theater, signs Short Snorter bill for Capt. G. W. Knight.

Short Snorter

Here, for the first time, is told the authentic history of the Short Snorters, exhumed from the dead past by the keeper of the sacred archives.

NEITHER honor, glory nor prestige, but a healthy yen for good hard cash explains the sometime sacred but herewith exposed organization of Short Snorters, according to none other than the self-alleged and undoubtedly self-proclaimed secretary of that mushroomed organization—W. I. Van Dusen, director of public relations of Pan American Airways System.

For years Van Dusen has maintained archives on the Short Snorters. He represents himself to be, and speaks with such an air of authority that he quite possibly is, the world's foremost authority on the famed but no-longer-elite flying club which has made many a pilot a pretty penny. From his voluminous files (memberships now total 200,000), Van Dusen has now compiled what he considers the last word on the subject. Many Short Snorters will be astounded to learn that their innocent conceptions of the organization have all been haywire.

Mr. Van Dusen, for instance, claims:

1. That Short-Snorting didn't begin when we started flying oceans. (Anyone with a good recollection of prohibition days can attest to this from his own experience. If he has no such experience he can't speak with authority anyway.)

2. That, though there have been at least 11 different theories on the start of the club, only two seem to have any validity.

3. That Short Snorters are not dyed-in-the-wool but dyed-in-the-cash.

4. That the official name of the organization, known originally only to the Founding Fathers, is "The Grand Order of Unbenevolent, Purely Mercenary, Short Snorters."

First, fellows, the history.

The two versions of equal authenticity are both concerned with long-time flyers who were always trying to emulate a certain currently popular radio comedian and "pick up a couple of bucks."

(*Continued on page* 128)

RULES AND REGULATIONS

GRAND ORDER OF UNBENEVOLENT, PURELY MERCENARY, SHORT SNORTERS

1) Any flyer (or individual who has done an impressive amount of flying) is eligible providing that (a) he (or she) can be vouched for as a "good guy"; and (b) has sufficient cash on hand to pay each member present one dollar and still produce a dollar bill for his own membership card.

2) No new member can be initiated by less than two bona fide Short Snorters present.

3) When a new member is being initiated all Short Snorters within calling range must be summoned to take part in the ceremony (at a buck apiece for the initiate).

4) The Short Snorter membership card is to be a one dollar (U.S.) bill, or equivalent in the coin of the realm. (a) It is to be made out by the senior Short Snorter present as follows: the name of the candidate is to be lettered across the top of the bill; vertically, on the left side, the date of the induction, vertically on the right side, the place of the induction. The candidate then is to sign the bill in his own handwriting, legibly, on the white margin along the side.

5) Thereafter, wherever over the world he may wander, the member must produce his signed membership card when challenged to do so by any other Short Snorter. Failing to produce the bill, the lax member will be required to pay to each Short Snorter present, upon presentation of his own properly-signed bill, one dollar or its equivalent, in cash, in the coin of the realm. As in the case of the original initiation, all Short Snorters within range must be summoned to partake of this ceremony.

6) The challenged member shall be allowed two minutes in which to produce his bill before a fine may be levied.

MADAME MECHANIC

Mechanic learners in engine repair section of the San Bernardino Army Air depot learn how to assemble radial engine under the watchful eye of man instructor.

☆

Unique woman-training program of San Bernardino Army Air Depot develops housewives into highly-skilled aircraft workers.

☆

BY the time a plane has had 1,000 hours in the air, it has required more man-hours of maintenance work than were necessary to build it originally at the plant.

Because of that, the Air Service Command of the Army Air Forces is now grooming a force of civilian mechanics to "Keep 'Em Flying" in this country. This civilian component is growing to be the largest centrally controlled industrial organization in the world—bigger than General Motors or the Ford empire.

In addition, Air Service Command will have the largest percentage of the more than 2,000,000 men of the Army Air Forces. There must be 10 of these mechanics and service specialists to every flyer who is kept in the air, it is estimated. With the duty of maintaining and repairing the Army's eagles of war, the Air Service Command is by far the biggest, numerically, of the nine Army Air Forces commands.

At present more than 85 per cent of the civilian trainees are women, with the others consisting chiefly of elderly men and men not physically qualified for military service. This work does not exempt a man from military service, and men eligible for the draft are not enrolled. The majority of these workers have had no previous mechanical experience and are started and developed from the beginning. Of the women, most of them are wives, mothers or sisters of service men who are determined to contribute their utmost to the earliest possible victory, and so bring home their men in a minimum period of time. It is because of the high proportion of women that this section of the ASC is termed the "Connie Command."

Most vital present task of the ASC is to recruit and train its required huge complement of mechanics. To accomplish this, an ingenious modern technique of industrial education has been devised and typical application of the system is seen at the San Bernardino Army Air Depot in California.

The San Bernardino Air Depot is among the newest of 11 major air depots established by ASC in the continental United States. It directs the operations of numerous sub-depots and installations throughout Southern California, Arizona and parts of Nevada and New Mexico. This huge multi-million dollar industrial-military establishment is located on 1,800 acres with numerous buildings now completed and more under construction.

Indicating the rapidity with which the entire ASC has expanded to service America's fighting planes, the San Bernardino Air Depot in little more than a year has expanded from a staff of four officers and five civilians to its present civilian and military personnel of thousands.

Here has been developed a process of technical training which has since been adopted at several other air depots and now is under the discriminating scrutiny of numerous war-production industries. Distinctive feature of the depot's processing techniques is a "selection system" of training to ascertain the specialty of aircraft mechanics for which each employee recruit is best fitted. This is recognized by today's industrial world as a vital contribution to the technique of grooming specialized industrial talent for the work of operating and maintaining modern machines and other duties.

Air Service Command depots must

(*Continued on page* 132)

WOMEN AT LOCKHEED HELP BUILD ANTI-SUB VENTURAS FOR THE NAVY

NEMESIS OF THE SUBMARINE, A NAVY PATROL BLIMP SKIRTS THE FLORIDA COAST

FIRE ALONE could not produce the tough, lean efficiency of a fighting Aeroprop. True, fire can toughen its hollow, rib-reinforced steel blades, but the Aeroprop is tempered in many other ways.

It is *tempered* by ceaseless engineering efforts to improve the very qualities which make the Aeroprop a favorite among pilots. It is light. Make it lighter. It is strong. Make it stronger. Simplify it further.

The Aeroprop is *tempered* in production where thousands of craftsmen build it to finest precision standards.

It is *tempered* in the test house where endurance runs test each performance factor under combat conditions.

It is *tempered* at the battle-fronts where Aeroprop technicians observe, check, and report the facts that can be used in building tomorrow's Aeroprops.

Yes, from drafting board to combat, the Aeroprop is tempered for flight—in the heat of furnace fires, in the minds of engineers, in the hands of skilled craftsmen, in the service of a host of pilots who fly for Victory.

Keep 'Em Flying!

BUY BONDS!

Aeroprop

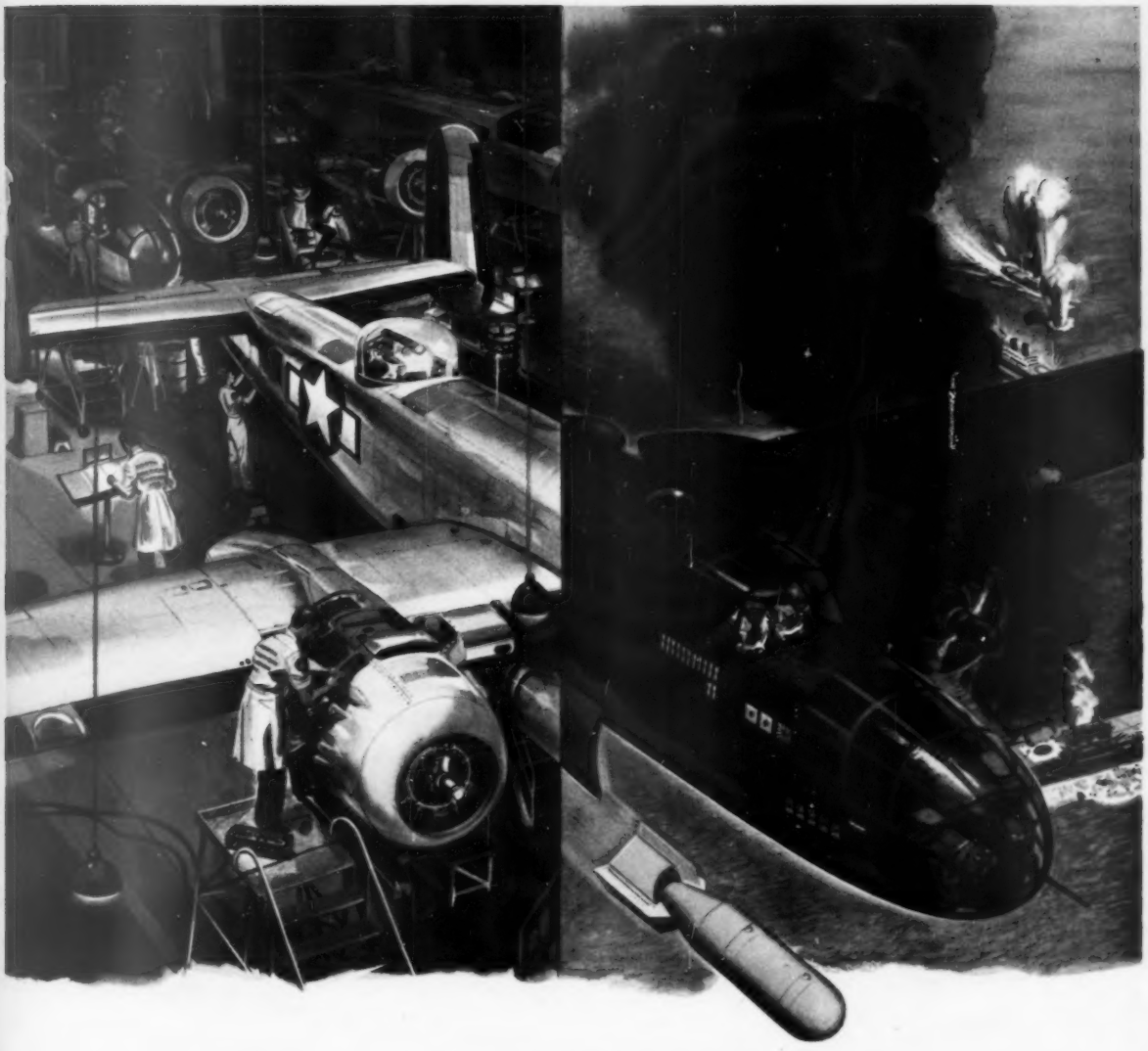
ARMY-E-NAVY

In War and Peace, Propeller Production at its Best!

AEROPRODUCTS DIVISION • GENERAL MOTORS CORPORATION • DAYTON, OHIO

GM ARMS FOR VICTORY

A CURTISS FALCON (SNC) SCOUT TRAINER TAXIES TO ITS PARKING PLACE.



Partners in the Pace that Wins

You hold your head a little higher. You reach across space and shake the hand of the bombardier of that B-25 Mitchell – the wildly happy American boy whose "Pearl Harbor forget-me-nots" have so accurately found their target.

In the crew of that Mitchell bomber are unseen thousands of determined American workers – the men and women who build North American planes.

On the production front, as on the battlefront, "North American Aviation Sets the Pace" – a killing pace for the Axis!

Trained employees accompany our planes to the battle zones. Their reports are added to suggestions from our engineers, test pilots, plant workers – and North American planes come off the lines better . . . sooner.

That's just another reason our nation can build Billy Mitchell bombers, Mustang fighters and Texan combat trainers . . . planes that are better than the best of the Axis brood.

Partners today . . . as we out-produce, out-fight the enemy. Partners tomorrow . . . as we build our new world for free men!

North American Aviation, Inc., designers and builders of the B-25 Mitchell bomber, AT-6 Texan combat trainer, P-51 Mustang fighter, (A-36 fighter-bomber). Member Aircraft War Production Council, Inc.

North American Aviation *Sets the Pace!*

Designing, Engineering and Building for Victory... and the Future...

Air Communications Products include: Radio Range Receivers, Glide Path Receivers, Marker Beacon Receivers, Aircraft Automatic Direction Finders, Aircraft Transmitters, Command Receivers, Command Transmitters, Small Transmitters up to 1 K.W., Interphone Equipment, Radio Telephone Equipment, Adaptors for Radio Compasses. Out of their achievements for war, Air Communications engineers will bring you new knowledge and experience of value in peacetime aviation development. *Cooperative engineering available.* Let us help you solve your engineering problems of the future.

Keep Buying WAR BONDS For Victory

★ The skyways of tomorrow will be paved with new safeguards resulting from new and amazing developments in air communications. Private planes as well as great commercial airliners will pierce the veil of fog, clouds and darkness with an ease and accuracy undreamed of only a few short years ago! Startling advancements already made in electronic communications, and assured developments yet to come, give us this portent of the future . . . *and Air Communications plans are directed toward that future!*

Now, Air Communications precision-built Products are being used to increase the operating efficiency of America's warplanes. After victory, Air Communications skilled organization will be at the service of America's great post-war aviation industry... ready with the advanced engineering and designing ability needed to produce *everything for the safety, convenience and economy of flying.*

AIR COMMUNICATIONS, INC.

KANSAS CITY 8, MISSOURI

DAM BUSTERS

By CLARENCE CURTIS

The war's most precise bombing mission was the destruction of the Moehne and Eder dams by mines dropped within an accuracy of only a few feet.

UNDER a bright moon, at midnight last May 16, 19 specially-modified *Lancaster* bombers took off from an air base on the east coast of England and headed eastward toward the continent. They met fighter opposition over Holland that sent three of them limping back home. The other 16 roared on toward secret targets.

At the air base which had sent them out, men clustered anxiously about speakers. Base headquarters was in constant radiotelephonic communication with the *Lanks* sloughing through the night, and in turn was in direct communication with Washington, where Sir Charles Portal, chief of the RAF Air Staff was conferring with Gen. Henry H. Arnold, commanding general of the U. S. Army Air Forces.

Tenseness was in the air as the *Lancasters* swung over their targets. It was communicated back to base headquarters and in the telephonic reports sent on to Washington. Not a few minutes of suspense, as in most bombing raids, but two and one-half hours of it as the circling bombers hugged the hills and treetops of the Ruhr Valley and were directed at intervals, individually, to go in for their tiny, all-important targets.

Nazi night-fighters hunted them ceaselessly, frantically, all the while. Flak probed for their vitals as they came dashing into the muzzles of the guns for their quick, precise thrust of bombs. Only eight of them got back.

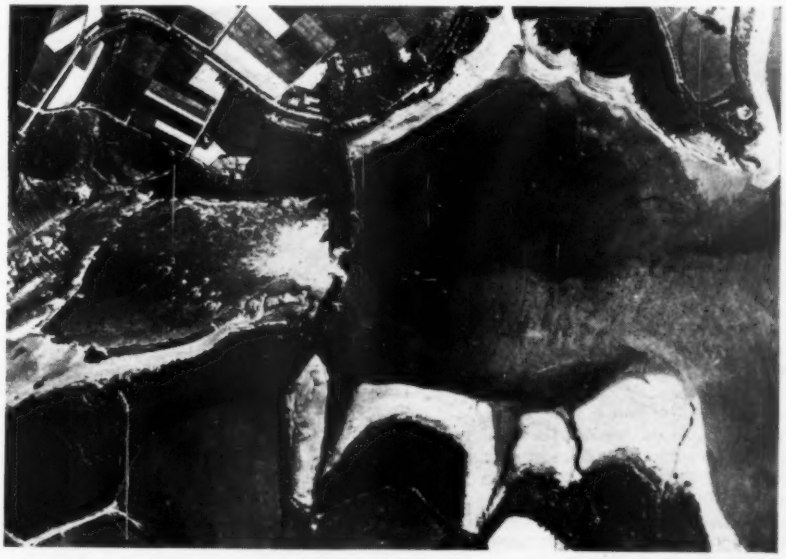
Their mission was the war's most precise bombing raid, and one of the most important and devastating—the destruction of the Moehne and Eder dams in the Ruhr Valley and the damaging of the Sorpe dam. The work of that night was equal to winning a battle.

The Moehne dam, holding about 135,000,000 tons of water, was constructed in 1911, to create storage of the surplus winter rainfall of the Ruhr catchment area —thus providing a reserve which could be released gradually during the summer months to maintain a fairly constant level in the river and protect the underground water table which provided supplies for industrial and household purposes. This table had been gravely imperilled prior to the dam's construction. The dam also improved navigability of the lower Ruhr, controlled winter flooding and maintained a constant flow of water for electrical power.

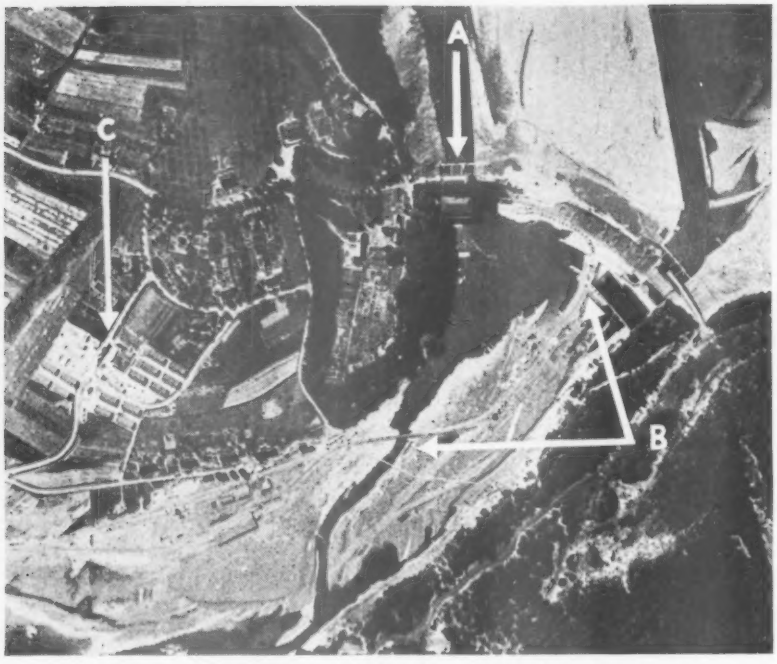
The Eder dam, holding some 200,000,000 tons of water, was constructed in 1914, primarily to prevent winter flooding of agricultural land and to assist in improving navigability of the lower Weser. The dam also provided some water for the Mittelland canal. Unlike the Moehne dam, the Eder dam had no water supply functions and was not related to the electrical generating system.

Almost immediately after the breaching of the Moehne dam the inhabitants of

Before. The Moehne dam with full reservoir before it was breached. Note torpedo net anchored away from face of dam. Mines had to be dropped between net and dam.



After. A few hours after the attack, a reconnaissance plane photographed water still pouring out of the 200-foot breach in the dam and the lake already drained of most of its water.



By late summer the Germans were starting to repair Moehne dam. Note first preparations (A), newly-constructed light railway (B), and workmen's camps (C).

Hamm, Dortmund and several other cities were ordered to boil their drinking water.

The effects on transport were serious and may be increased by winter floods. Shipping on the Ruhr and lower Rhine rivers was held up for a week by the flood water and debris immediately after the attack. Washing of silt into the Rhine was expected to present an additional problem. The breaching of the dam released floodwaters which disrupted land transport. One of the four main rail lines leading eastward from the important Ruhr Valley was put out of action for several months. Major repairs were necessary on a great number of secondary and main lines in the area. Much of the rail system was on "made" land, especially susceptible to washing, and much of the track has had to be reballasted and relaid.

A number of small power stations were damaged and others submerged. If the ground water level was affected the results will be felt throughout the war.

The breaching of the Eder dam caused serious damage to agricultural land and industrial installations and this damage is expected to increase during the floods of the present winter. Parts of the important industrial city of Kassel were flooded. Canal traffic on the Weser and Mittelland canals was dislocated and several local rail lines and one main rail line seriously damaged. Three fairly important electric power stations were destroyed farther down the valley. The underground hangars and officers' mess at Kassel training airdrome were flooded. The floods created by the attacks had serious effects on morale.

Such was the damage wrought by this raid.

As the blow-by-blow account of the attacks on the dams came in to the flyers' home base, the ground crews followed their progress breathlessly from the Moehne to the Eder dam and on the Sorpe dam diversionary attack.

In Washington, the report of "dam breached" which followed the first two attacks brought shouts to the throats of hardened airmen. At the home base, the enthusiasm was tempered by the knowledge of losses among their comrades. The *Lancasters* came straggling back to England. The last to land, about 5 a.m., was Wing Commander Guy Penrose Gibson, who had organized, trained for and led the air war's most amazing mission.

Commander Gibson sat easily behind a desk in the British Information Services in Chicago as he told his story. His voice was unhurried, and occasionally a reassuring grin would flicker on his face. He was not tall, a bit stocky—he had started as a fighter pilot flying *Beaufighters* during the first part of the war. Yet perfectly controlled and assured as he was, his fingers trembled slightly as they held a cigaret and crushed it in the ash tray. At 25 he had completed 174 raids on the continent. The destruction of the dams was his last.

He had come with Prime Minister Churchill to attend the Quebec conference. Now he was visiting air bases and schools in the United States and Canada, was eagerly heading for Hollywood.

Wing Commander Gibson was born in 1918 in Simla, India, where his father was in the government forestry service. His family returned to England when he was six, and young Gibson attended a school in Oxford. Then in 1936 at age 17, he volunteered for service with the RAF.

When the war broke out his chances of surviving for 174 missions were infinitesimal. Wing Commander Gibson hasn't bothered to figure out what those chances were mathematically, but on each raid he had about one chance in 20 of not coming back. He speaks of it quite matter-of-factly. He has seen too many of his friends lost to believe it is anything more than luck. Since he left England his own crew has been lost in action.

The destruction of the Ruhr dams did not begin on the night of May 16. Planning for the raid began long before. Training for it had taken the entire time of Gibson's bomber squadron for three months. He was chosen to handle the job because he was the most experienced bomber pilot still flying.

To understand just how difficult the mission was, Wing Commander Gibson described the targets. The Moehne dam was approximately a half mile across and constructed of reinforced concrete. It was about 145 feet thick at the base and 140 feet high, and held back the Ruhr River. The Eder dam was quite similar and held back the River Eder. The Sorpe dam was a large earthen dam and the attack upon it was primarily a diversion, although it is still leaking from the effects of the bombing.

The dams were protected by antiaircraft guns and by barrage balloons. Heavy torpedo nets were anchored about 50 feet away from their crests. Excellent British aerial reconnaissance and intelligence work reported all these facts and it was calculated that a successful attack upon them must involve the placing of explosives within an accuracy of 15 feet.

This entailed other extremely difficult problems, including the development of special mines containing an unidentified explosive. In order to place the mines as accurately as demanded, the attack would have to be conducted at a low level in the face of bitter flak opposition, complicated by the protecting barrage balloons.

Further, the attack had to be made during the chosen week in May in order to have the water behind the dams at its optimum level.

Commander Gibson trained ' is squadron at an east coast air base. Despite the three-month grace period there were times when it seemed they could never be ready in time. There were heartbreaking disappointments. The mines didn't work well at first. They had trouble with the radio telephone. They had to have special training in flying at low level because of the peculiar tactics to be used. They had special problems in flying over calm still water at a height of exactly 50 feet because of the tremendous difficulty of gauging their height.

To be fully effective, the mines had to be dropped from the exact height of 50 feet—not 48 feet, not 52 feet, but 50 feet. No altimeter could guarantee such an exactitude and several devices were tried without success. Then one of the crew members, who had watched two spotlights converging in a vaudeville show, suggested that two lights be affixed to the aircraft—one under the nose and the

(*Continued on page* 148)

Compiled and edited by the Washington staff of FLYING.

Gallant Eagle

Secretary of State Cordell Hull came off so well on his first airplane flight that Winston Churchill called him a "gallant eagle" after the 26,000-mile mission to Moscow was completed. Mr. Hull, not to be outdone, submitted modestly that flying was a wonderful thing and a great convenience, but refused a direct quote. After considerable debate among ourselves and consultation with a couple of confidential advisors on protocol, we make bold to conclude that the State Department is willing to concede that the flying machine is here to stay.

This could not have been said before the flight, on which Mr. Hull was accompanied by two personal and skeptical physicians who kept close watch on the Secretary while the Douglas *Skymaster* tried it at 5,000, 6,000, 7,000 and then boldly pushed up to its normal operating altitude.

Whether from anxiety over their chief or for more mundane reasons, some of the watchers got air sick. Mr. Hull didn't. He got a kick out of being served ice cream while flying over the green valley of the Nile, and was so impressed with the view of Jerusalem and Bethlehem that the plane circled them twice.

Gin rummy and sleep took up the time coming home and the flight was without incident until the last minute. Passengers woke with a start as the plane circled for a landing to find that Mr. Hull had disappeared. They were even less at ease when they discovered where he was. The gallant eagle had gone to the cockpit to watch the landing and came out beaming with another quote which, it is insisted, must also be indirect.

Mr. Hull declared that aviation was an amazing miracle.

After two unsuccessful weeks of trying to get him to say it with quotes, we are inclined to add that aviation has nothing on protocol.

* * *

The Lea Bill

HR-3420, the Lea bill, will not come up for a vote before the House until early January—about the time this issue appears on the newsstands. Perhaps it will not come up even then.

This is in line with its history. It will soon celebrate its first birthday, but has experienced delays from the beginning. First these were owing to need for revisions, which took up most of last spring and summer. The bill was finally approved in committee by a vote of 17 to nine, but the nine led by Congressman B. Carroll Reece (R. Tenn.) promptly came up with HR-3491, which, while opposing the Lea job, also plays up to the desires of railroads, steamships and other transportation rivals of the airplane.

The Lea bill was scheduled to come up for a vote late in November. To get a bill up for a vote, it has to go before the House Rules Committee which, in turn, passes it on for a vote. Before passing it on, however, Rules may hold hearings on whether the vote is in order. Rules says that this is a grave question. At least 13 congressmen, including most, if not all, who backed the Reece bill, announced to Rules that they wanted to be heard. They feel, according to reports, that too few hearings were held on the Lea bill when it was under discussion—for weeks on end—during last spring and summer. Also to be heard from—since the opposition is going to testify—are at least some of those favoring the bill, including Mr. Lea. And so forth. The wheels of the congressional gods grind slowly.

Whether they will grind exceeding small in the case of the Lea bill is a question that even its best friends hate to face. Late in the summer they were optimistic that there would inevitably be last-minute revisions, but the bill would eventually go through essentially as written. Now after four months of concerted campaigning by the opposition, they are less sure, if not uncertain.

Opposition comes from a number of sources. Railway and steamship interests lead the offensive, and they are powerful opponents. They have capitalized on the hurt feelings of state aviation commissions, whose members believe that the bill will run them out of business. And behind the scenes is the quiet, but nevertheless persistent, opposition of the Department of Commerce, under which the Civil Aeronautics Administration now functions and from which it would be taken if a separate Civil Aeronautics Commission were set up, as the Lea bill provides.

(*Continued on page* 106)

Mrs. Hull greets the State Department's "gallant eagle" upon his return to Washington from 26,000-mile flight to Moscow in Douglas Skymaster transport.

INSTRUMENT FLYING MODERNIZED

Bryan instrument school substitutes modern blind instrument flying for the older, nerve-wracking needle-ball-airspeed system.

Col. Joseph B. Duckworth, commanding officer at Bryan Field, who helped devise new training system.

INSTRUMENT flying, a skill comparatively neglected during the easy-going days of peace, has assumed its proper importance through the exigencies of World War II. Today, a combat pilot must be "the compleat man" aeronautically; the days when he could sit around comfortably waiting for weather to clear are gone.

When the world was at peace, the majority of pilots flew "contact" only, through visual reference to the ground or the horizon. If weather or nightfall obscured visibility, they simply did not leave the ground.

But war has changed the theory of flying in many ways, one of the most important of which is the increased emphasis now placed upon instrument flying. The safety of the crew, the plane, and the pilot himself frequently depends solely on his competence in instrument flight.

Picture a heavy bomber, one engine shot out, radio dead, limping home through a thunderstorm after a night raid on Germany. Obviously, the pilot, if he is to find his way back to his base, has only his instrument panel to rely upon.

Recognizing the tremendous importance of instrument training, the Army Air Forces Training Command is teaching at Bryan, Texas, a modernized system of blind flying called the "full panel" system.

The instrument pilot instructors school there is the only one in the AAF; its student officers are seasoned pilots when they enter. At the end of their course, they will be equipped to teach instrument flying at Training Command installations throughout the United States. Thus virtually every Army pilot in combat eventually will have been instructed in the method taught on the flatlands of Texas.

The new technique replaces the old

Typical instrument panel in North American "Texan," advanced trainer which is used in teaching full-panel instrument flying at AAF Instructors' School, Bryan, Tex.

"1-2-3-" or "needle-ball-airspeed" system, which the Army believes tended to make flying too mechanical.

If the needle moved to the right, the pilot kicked left rudder; if it moved to the left, he kicked right rudder; if the ball moved off center, he brought it back into position with the stick; if the airspeed dropped, he nosed the ship down. He did not realize that aerodynamically the plane would fly under instrument conditions just as it did under contact conditions.

Because of this robotical method, the pilot was apt to overcontrol his plane by "chasing the turn needle." The excess of concentration in trying to steady two instruments frequently led to tenseness, discouragement, fatigue and sometimes panic.

The new-style instrument flying, as taught at Bryan, has none of the disadvantages of the "needle-ball-airspeed" system, but instead provides a close connection with contact flying.

Every pilot knows a plane's performance is determined by its "attitude"—the position of the nose with respect to the horizon and the amount of the bank of the wings. The same situation obtains, regardless of whether the pilot is flying blind of contact.

When flying blind, the full panel pilot cross-checks his instruments to determine whether the plane is doing what he wants it to do. The little horizon bar or gyro flight indicator, which simulates the plane's position in relation to the actual horizon, gives the man in the cockpit his center of reference.

But other instruments also provide indications of the ship's attitude. For instance, the turn indicator and horizon bar may show and control banks, while pitch may be indicated and controlled by the altimeter, airspeed meter and rate of climb indicator.

The student at Bryan Field, as his eyes sweep the full panel, is provided a natural, easy and interesting approach to the use of all his instruments. He is indoctrinated with confidence in them, whereas in the old days flying blind was a burdensome chore in which the flyer, nervous, tired, and sometimes scared, spent half his time praying for the opportunity to see the ground again.

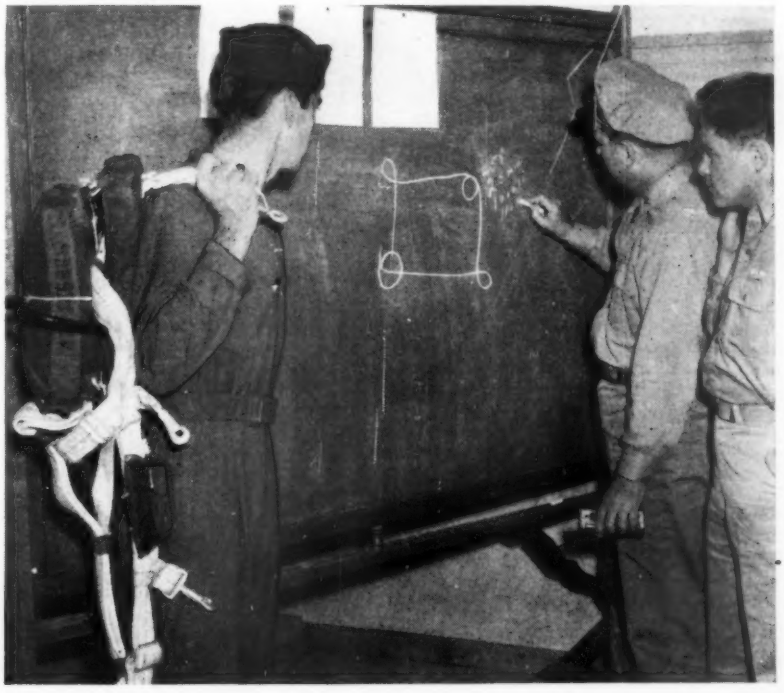
Much of the "flying" at Bryan Field is done on the ground, where the embryo instructor gets a comprehensive picture of what he is going to teach—and the teaching aids he will have at his disposal. The ground school is closely co-ordinated with actual flying so that the student receives full instruction about the topics before he goes into the air.

Sensations of instrument flight, care of instruments, aerodynamics, psychology of teaching, radio range orientation and numerous other subjects are covered in the ground school, which absorbs approximately 50 per cent of the time the men are stationed at Bryan.

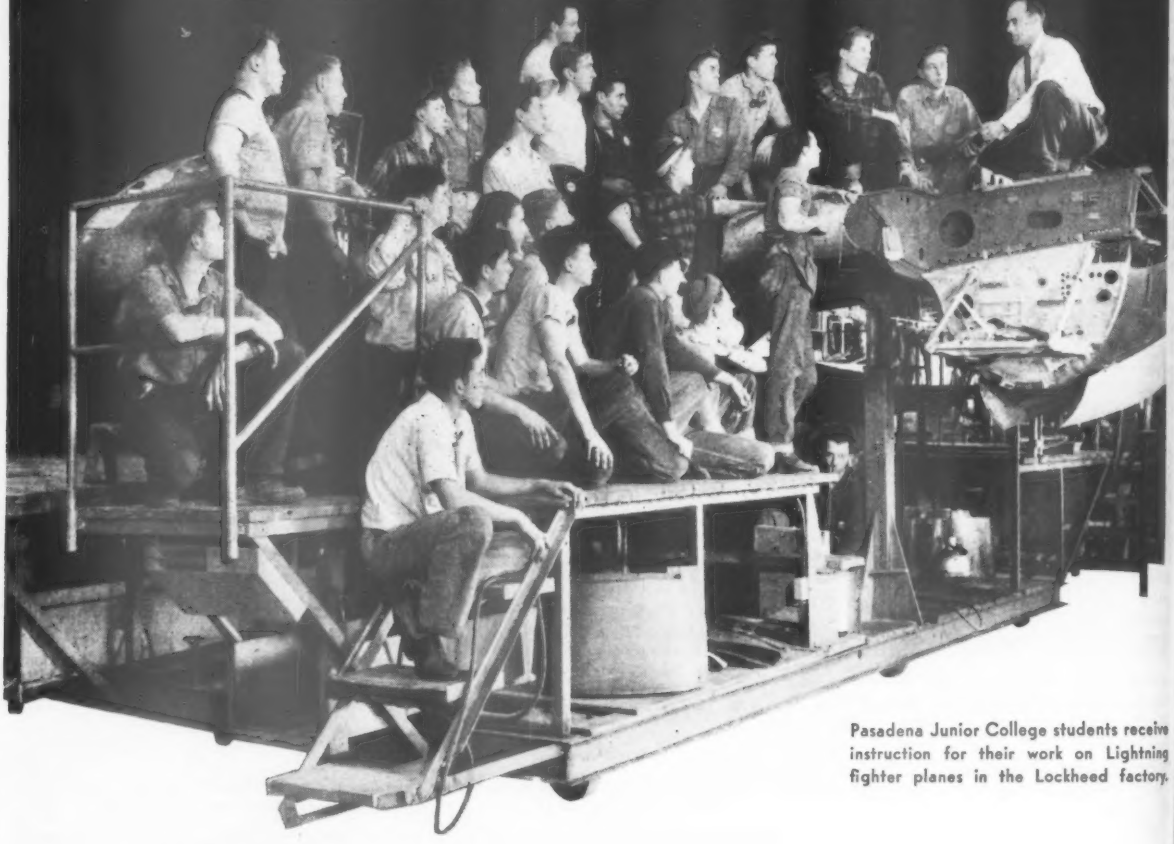
When the instructors leave the instrument school, they have learned to relax under the pressure of instrument flying and to concentrate on precision performance. This same ability is subsequently transmitted to their flying students. END

★ ★

Pilots get final explanation of their flight pattern before taking off for instruments tests. Students must complete missions accurately within specified time limit.



"BOYPOWER"



Pasadena Junior College students receive instruction for their work on Lightning fighter planes in the Lockheed factory.

By BARBARA M. SEWALD

With approval of educators, aircraft plants employ youths on a co-operative education-production basis.

IN AN effort to alleviate the critical labor shortage, Southern California aircraft companies have developed a plan under which they employ male minors, boys of 16 and 17, on a co-operative education-production basis. Several thousand boys are employed by Lockheed and Vega [Vega recently was absorbed by Lockheed] in Burbank and at the Douglas plants in Santa Monica, El Segundo and Long Beach. Douglas also has a number of 16- and 17-year-old girl employees.

Forty-five high schools in Los Angeles county participate in the program. Burbank, Pasadena and Glendale were among the first to provide students under the four-four plan. At Lockheed and Vega, the boys either go to school four hours and work four hours daily, or they work four weeks and go to school four weeks. Three four-hour shifts are available under the first arrangement. Boys who work on the four-week schedule have two full-time shifts, 7 a.m. to 3:30 p.m. and 1:30 to 10 p.m. This is the first swing shift for boys on record. At Douglas, the boys work the four-hour schedule—four hours of school and four hours of work. The majority of minor workers at Douglas are employed on the swing shift. At both plants workers under 18 who are graduated from high school work a full shift.

School credit is given in vocational subjects for work done in the factory. This enables the boys to be graduated with their class on schedule. Each school system provides a co-ordinator—a teacher who is given a regular visitor's pass to the plant and serves as boys' counselor.

El Monte's Union High School accepted a bid by the Douglas company to establish an assembly plant in the gymnasium on the campus. Under the four-four plan both boy and girl students work four hours daily. The plant is the only one of its kind in the country where school employees make up three of its four shifts of workers.

The boys are not placed in jobs that would be hazardous to their health or well being. They soon prove capable of doing most jobs adult workers do. Two Pasadena schoolboys, working on the plexiglass hatches of the Lockheed *Lightnings*, tied the department record for speed that had been set up by a team of three men. One of these, 17-year-old Robert Woolnough, has been able to do more work with less breakage of tools than anybody ever assigned to this job. He broke only two drills in two days. Usually a new man on this job breaks from 12 to 18 drills a day.

The boys require little supervision during the training period because they are familiar with tools through the modern school curriculum which stresses vocational subjects. The kid jallopy mechanic is soon converted to a full-fledged war worker. Most of them study blueprint reading, drafting, metallurgy and trade mathematics to supplement their factory work.

Among the various jobs the boys have

been assigned are those of form block makers, skin fitters, welders, riveters, detail draftsman, turret lathe operators, filers and burrers, metal fitters, tool makers, process and heat-treating, plumbers, fabricators, riggers, machine shop trainees and junior service mechanics, who help install and overhaul motors.

Many of the boys are in non-productive activities such as blueprint control clerk, tool crib attendant, mail boy, production control clerk, hand truck operators, shipping and spare parts clerks, stock room assistants and several are inspectors. Sixteen-year-old, Leonard Gardner, inspector of electrical equipment at Douglas, is working to buy a car and to pay his tuition at a radio technology school. He holds an amateur and second class commercial radio license.

Five mathematics students who had two years of drafting are in template design, learning to be tool and die designers at Vega. One boy is in manufacturing planning, a department that governs the flow of planes and material through the factory.

Several hundred boys at Douglas do general assembly in the *Skymaster* hangar and a number are in the cowling section of the *Havoc*. Some of them are general installers, (hydraulic, electrical, radio and armament). Eight boys who install armament on the *Flying Fortresses* and *Ventura* bombers at Vega, are the envy of the rest of the boys in the factory because they get to handle machine guns. One of them, 17-year-old Dick Fox, won a bet by oiling and putting together a .50-caliber machine gun blindfolded in 20 minutes. He had bet he could do it in 30. Three weeks after he came to work he was so enthusiastic he talked his grandmother and grandfather into coming to work at Vega. They are both over 60. She is in process and heat treating and he is in final assembly.

In some instances, boys who work on the four hour shift and double duty adult workers (those who work four hours in defense plants in addition to their regular work) keep machines from standing idle by maintaining one machine on a fulltime shift.

The boys are identified by a small star on their badges at Lockheed, the blue background on their badges at Vega and "M" (for minor) at Douglas. There is a high competitive spirit between the various high schools. The boys take a real interest in the daily work chart which shows how each shift stacks up and they do their best to see that nobody beats their shift.

Mort Bach, Vega works manager, declared: "Boypower is the biggest single stimulus to employment since the introduction of women in the factory. It has provided us with some of our outstanding workers and our fewest employee problems." The boys have the lowest absentee rate of any group in the factory.

The boys are all keen aviation enthusiasts and the majority of them build model airplanes. George Marygold, 17, one of the first boys hired at Vega, has two inventions that Vega is now investi-

(*Continued on page* 170)

Boys of North Hollywood High work on Lockheed-built Flying Fortress. There are two education plans, under which boys attend school on four-hour or four-week shifts.

Mrs. Julian Potts and 17-year-old son Robert work together on bomber assembly at Douglas aircraft factory in Santa Monica. Another son is in the U. S. armed forces.

FUTURE AIR TRAFFIC CONTROL

The Civil Aeronautics Administration is preparing now for 1950's anticipated air commerce, based upon an analysis of specific data.

THE future trends of air traffic and possible limitation of traffic flow by airway and airport capacity are discussed in this report, prepared by the Air Traffic Control Division of the Civil Aeronautics Administration. Conclusions are reached which indicate that although it is possible that the flow of air traffic may, at some time in the future, be restricted by the capacities of airways or airports, such a condition cannot exist under all weather conditions, and that under certain common weather conditions traffic will not be restricted by airway or airport capacity. This report indicates that the capacity of air traffic control facilities is the only remaining possible limitation to the flow of air traffic.

In attempting to formulate statistics representing past, present and future air traffic conditions which will serve as a basis for planning future air traffic control service, aircraft movements handled by airway traffic control centers are used as basic data. Accurate records of such aircraft movements have been kept from the inauguration of airway traffic control to the present time. By "aircraft movements handled" is meant the total number of flight operations (instrument flight rule flights and contact flight rule flights) on which flight information has been received and handled by the airway traffic control centers. An aircraft movement, as counted by an airway traffic control center, consists of a landing in or a takeoff from within the control area of the center. If an aircraft flies through the area without landing, two movements are counted. Thus, these data reflect the amount of flight plan traffic moving from point to point and are not distorted by the local airport activity or flights operating without flight plans in accordance with contact flight rules.

From the graph in Figure 1 it can be seen there has been a continually larger increase in the number of aircraft movements handled each year. The number of aircraft movements handled during the fiscal year 1942 (6,222,608) was more than four times that handled during 1941 (1,504,231). Some of this increase has been due to military traffic, but there has been also a very large increase in civilian flying. This can be attributed in part to the Civilian Pilot Training Program of the Civil Aeronautics Administration which, prior to and during the early part of the war, trained thousands of civilian pilots, but has since been reorganized as the War Training Service and is exclusively training military pilots for the armed services.

It is interesting to note the large total traffic increase despite the curtailment of airline operations caused by the assignment of half of the airline aircraft to the military services, and despite the curtailment of private flying activities in the vital defense zones along the east and west coasts.

An estimate for the year 1943 can be quite accurately determined based on the rate of increase during 1942, and the traffic figures for the major portion of the fiscal year 1943.

There were 4,502,307 aircraft movements for the first 10 months of 1942 and a total of 6,222,608 aircraft movements for the entire year. Figures now available show 8,730,699 aircraft movements during the first 10 months of 1943. Based on these figures and taking into consideration the fact that an exceptionally heavy amount of traffic followed our entry into the war, it is estimated that airway traffic control centers will

The Atlanta, Ga., Air Traffic Control Center in action. Flight progress board (left) shows movement of all planes in territory.

Typical CAA Air Traffic Control Center showing use of magnetic map for continuous check on positions of planes aloft.

handle a total of between 11,000,000 and 12,000,000 aircraft movements during the fiscal year 1943.

A study of future trends of air traffic is necessary in order that some realization may be obtained as to the probable magnitude of the air traffic control problem. While it is not possible to make a forecast of air traffic conditions with any degree of certainty, still some estimates and approximations can be arrived at which will be helpful in planning the future air traffic control service. It can be said with certainly, however, and all experts agree on this point, that the industry is still in the development stage and therefore far from having reached the point where its expansion will become stabilized.

A few statements recently made by aeronautic experts which indicate their views concerning things to come in aviation, follow:

Glenn L. Martin says his firm can build a 250,000-pound flying ship, able to carry 80 tons of bombs or cargo to Europe at a speed of more than 300 m.p.h. Thus, 8,300 of such gigantic planes could move tonnage, in the course of a year, equivalent to the yearly freight capacity of the entire merchant marine of the world; 45,000 would be the equivalent, in carrying capacity, of this country's 1,-900,000 freight cars.

Allen Lockheed says "It is impossible to give your imagination rein enough when you think of the next 20 years in aviation. In design as well as construction the plane of tomorrow will be as far ahead of present planes as they are ahead of the first ones. That will be one good result of the war, which has advanced aviation a generation in the space of a few months." Lockheed envisions great airliners capable of carrying 300 to 400 persons (he says such a plane could be built now), but his own ambition runs to the family model—"one for the general public." The plane is on Lockheed's drafting board now. It's a five-place, twin-engined, amphibious craft and he says it's the kind of aerial runabout that the Joneses won't want to do without a few years hence. Lockheed expects the cost of this family plane to be less than $3,000, brought to that figure through quantity production. It should get, he estimates, 16 or 18 miles on a gallon of gasoline, with the engines embodying all the engineering advances he sees in the offing.

Harry Woodhead, president of Consolidated Vultee Aircraft Corporation, stated in May, 1943, "For many months we have been working on a 400-passenger plane which is now in the mock-up stage. That means we have a wood replica of the completed job."

Frederick G. Miles, British aircraft designer, predicts that within three years it would be possible to produce 100-passenger planes with a cruising speed of

320 m.p.h. for traffic between New York and London.

Thousands of persons will be flying helicopters when the war is over, using backyards as landing fields, Igor Sikorsky told members of Congress in June, 1943, demonstrating the plane that rises and descends like an elevator or stops in mid-air as well as being able to proceed in level flight forward or backward. Mr. Sikorsky said that within the last two years all of the engineering problems connected with the helicopter have been worked out.

These experts confirm beyond doubt that the possibilities of air transportation are practically unlimited. After the war, there will be millions of persons who will become markets for things they never bought before. No people and no market will be inaccessible. Air traffic will affect what they eat in China and India, their living conditions, the hours they work. It will industrialize small and remote places with wealth that has not been successfully tapped because of travel difficulties. In turn, all of this air activity the world over will have the effect of increasing the intensity of air traveling over the continental United States.

However, other persons, less experienced in aviation, have made claims which might lead one to expect too much from air transportation. These extravagant claims have been counteracted by "down-to-earth" statements from those who have really devoted considerable time to the study of the future of aviation, among them being W. A. Patterson, president of United Air Lines, and Edward P. Warner of the Civil Aeronautics Board.

Mr. Patterson said in a recent statement that some people had allowed enthusiasm to overcome better judgment in predicting the end of railroads and steamship operations. He predicted, however, that within 10 years domestic airlines will carry 80 per cent of the nation's first-class passengers, 75 per cent of all first-class mail moving more than 450 miles and 50 per cent of all express packages. Such an expansion in business, he said, would require a fleet of at least 5,250 planes, as compared with 365 at the beginning of the war.

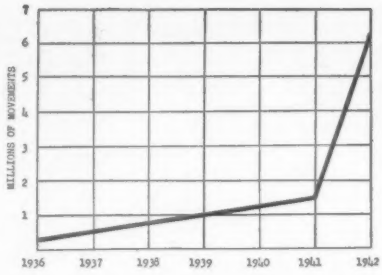


Fig. 1, showing plane movements in millions.

Extremes of both extravagance and conservatism must be avoided when planning the air traffic control service of the next 10 years. However, the growth of air transportation and flying activities in general have been very difficult to predict and most of the predictions made in the past by experts after considerable research and study have fallen short of actual expansion.

Therefore, as a safety measure and to guard against those mistakes of the past, air traffic control facilities must be planned for the adequate handling of a traffic somewhat above the expected minimum.

With this in mind, we have weighted down the optimistic views and tried to strike a balance between the forecast made by the National Resources Planning Board in its report on "Transportation and National Policy" (transmitted to Congress by the President in November, 1942) and other forecasts such as those made by Mr. Warner and by the recent report of the Office of War Information.

In estimating the amount of air traffic in years to come we have in addition made use of the experience accumulated in the air traffic control service since its inception.

The National Resources Planning Board makes the following passenger traffic forecast, in its report on "Transportation and National Policy":

"In the last 10 years, to the end of 1940, revenue passenger-miles flown on scheduled domestic airlines have increased from less than one per cent to approximately 12 per cent of Pullman passenger-miles. While much of this air traffic represents a diversion from rail and highway travel, a substantial portion undoubtedly is genuinely new traffic, brought into being by the acceleration which air transportation affords.

"A large number of factors have contributed to the growth in passenger traffic, among them the vastly increased comfort of air travel, the more frequent schedules, greater speed, *fewer cancellations or delays, better traffic organization* and promotion, *greater reliability.* Most important of all has been the remarkable advance in safety: in the last five fiscal years there has been an accelerating rate of improvement in operating safety, particularly on domestic routes.

"Thus, in 15 years from the start of scheduled domestic air transportation service, airlines have reached a point equal to the level of safety attained by rail carriers 70 years after the start of rail transportation.

"Extrapolating the general safety curves for both air and rail carriers suggests that the two safety trends will merge by 1950.

"Since accidents in any form of transport obviously can never be completely eliminated, it appears reasonable to predict that within the next decade the safety factor will cease to be a serious deterrent to air travel on the part of the vast majority of travelers.

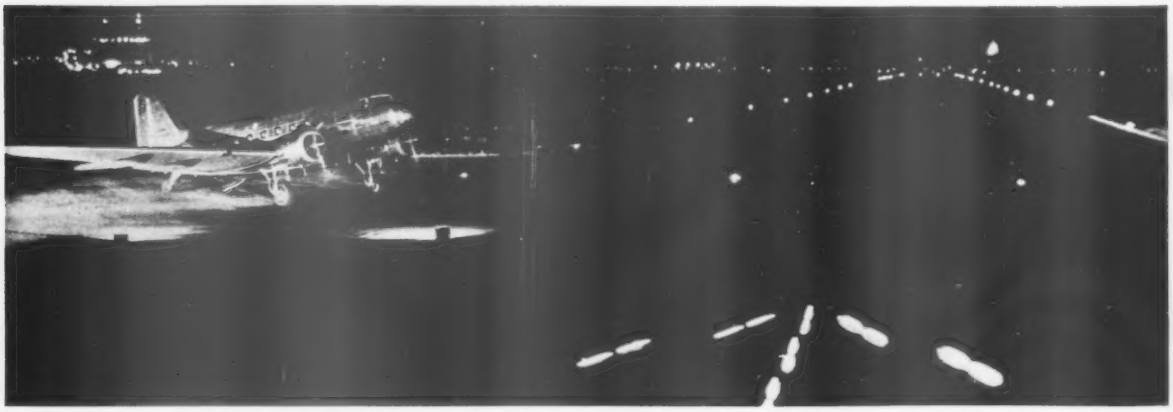
"With increasing public acceptance, the factors which have so far contributed to the growth of passenger traffic will decrease in relative importance and the question of fares will become increasingly significant.

"Pullman traffic, in 1939, approximated 8.5 billion passenger-miles at an average rail and Pullman charges of slightly over three cents per mile. Average airline costs per capacity-seat-mile, we have seen, are tending toward one and one-half to two cents and load factors toward 60 per cent. Hence, an average airline charge not much, if any, above three cents per mile appears to be in sight within a predictable future.

"Taking into consideration savings in meals, hotel bills and incidentals, such a rate in many instances would be con-

(*Continued on page* 140)

Douglas DC-3 awaits signal from Washington control tower before taxiing onto runway for night takeoff. Capitol dome is in distance.



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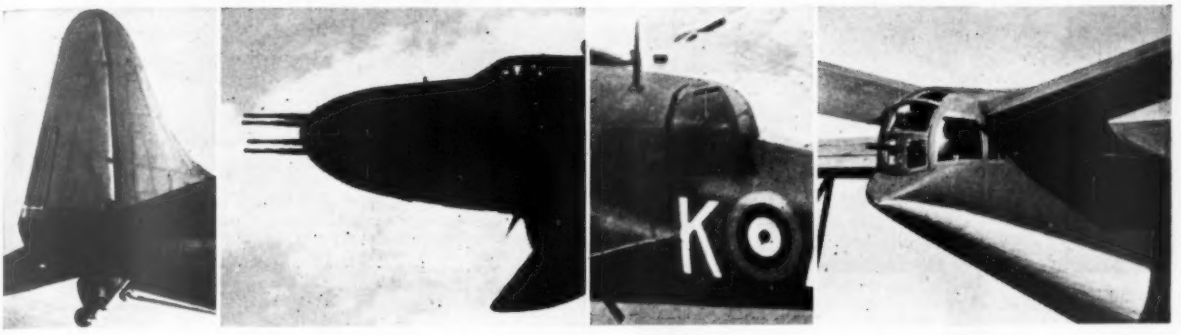

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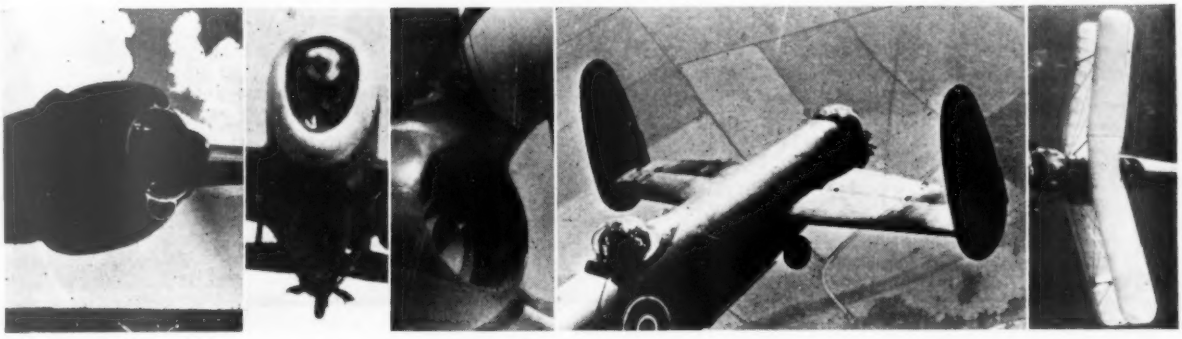

5 6 7 8 9

The planes are: 1. Douglas Dauntless; 2. Douglas Havoc (P-70); 3. Bristol Beaufort; 4. Martin Mariner; 5. Lockheed Constellation; 6. Republic Thunderbolt; 7. Hawker Typhoon; 8. Avro Lancaster; 9. Bucker Jungmeister.

MISTAKEN IDENTITIES

CONTINUING the clarification of differences between the often-confused Douglas *Skytrain* (or *Skytrooper*) and the Curtiss *Commando*, the side views of each are shown below to exact scale. The two bottom views were shown last month. Note that the *Commando* is a low-mid wing monoplane, has fully retractable landing gear and differs widely in the nose.

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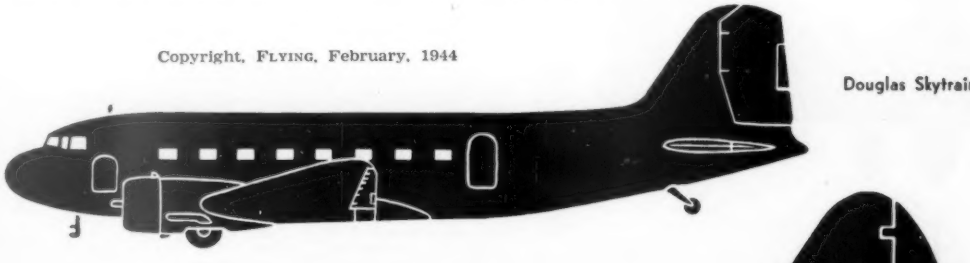
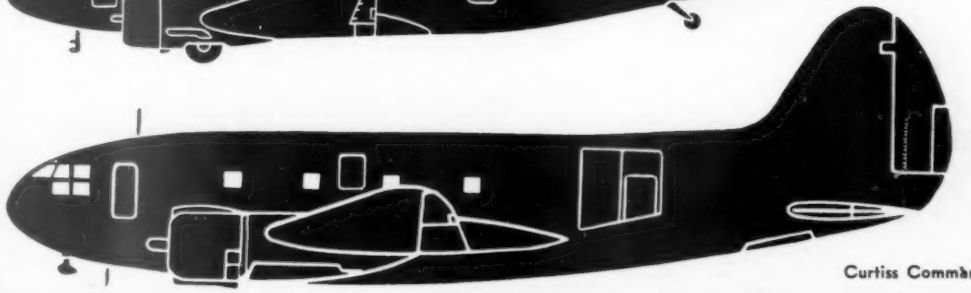


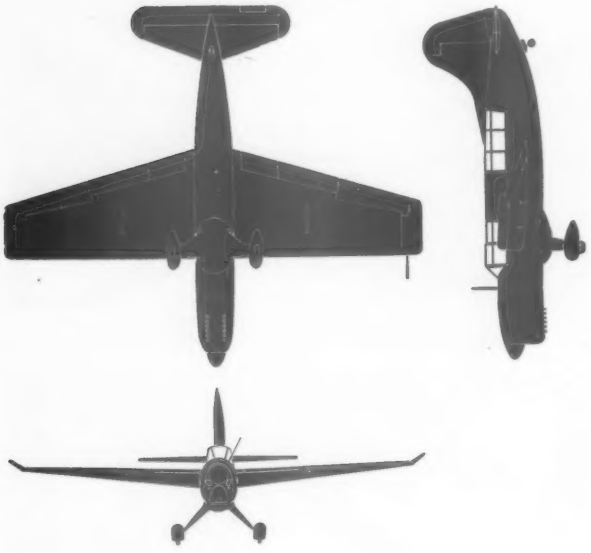
Douglas Skytrain. Length: 64 ft. 5½ in.



Curtiss Commando. Length: 76 ft. 4 in.

CURTISS SEAGULL

Scout-Observation



PERTINENT FACTS: Currently the most widely-used scout-observation type in the U. S. Navy, the *Seagull* is used as a catapult seaplane aboard battleships and cruisers, and, on wheels, aboard carriers. Numbers of these planes are in use in the British Navy, where they are named *Seamews*. Powered with a 520 h.p. air-cooled inline Ranger engine, the *Seagull's* top speed is just over 175 m.p.h. Normal range is about 1,000 miles, service ceiling over 15,000 feet. Wing span is 38 ft. 10 in., length, 35 ft. 8 in.; height, 16 ft. 7 in. It carries a crew of two. Armament is probably three machine guns.

WHAT TO LOOK FOR: The unusually thick mid-wing has pronounced dihedral on the underside, straight leading edge, tapered trailing edge and squared-off, upturned wing tips. The deep fuselage is marked by the two separate cockpits and the high tail with swept-forward vertical fin. Neither wheels nor floats retract.

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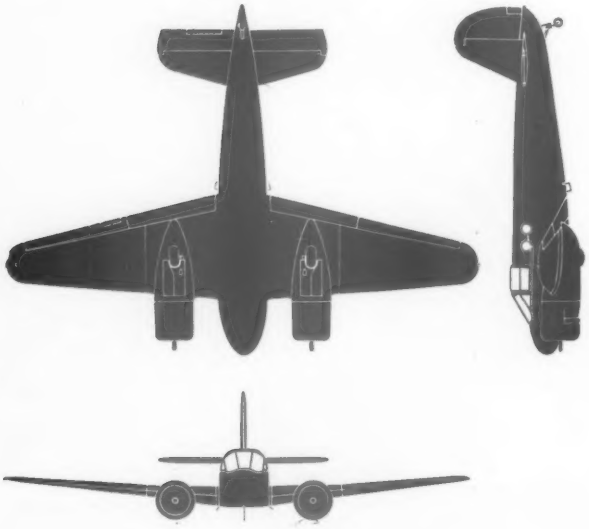
BEECH WICHITA

Advanced Trainer



PERTINENT FACTS: A twin-engined type commonly seen throughout the southern United States, the Beech *Wichita* is a favorite advanced pilot-trainer in the AAF. Technically the AT-10, the *Wichita* is powered with two 280 h.p. Lycoming radials which give it a top speed of 197 m.p.h., cruising speed of 176 m.p.h., and stalling speed of 64 m.p.h. Normal range is 925 miles, service ceiling 19,800 feet. Wing span is 44 feet, length 34 ft. 4 in.; height, 9 ft. 2½ in. Gross weight is 6,000 lbs., empty weight, 4,750 lbs.

WHAT TO LOOK FOR: The low cantilever wing has moderate dihedral, slight leading edge taper and considerable trailing edge taper. The engine nacelles project nearly as far as the fuselage nose. The fuselage is square and slab-sided. The tail unit is conventional, with fixed tail wheel mounted directly under the rudder. The main wheels retract into the engine nacelles.

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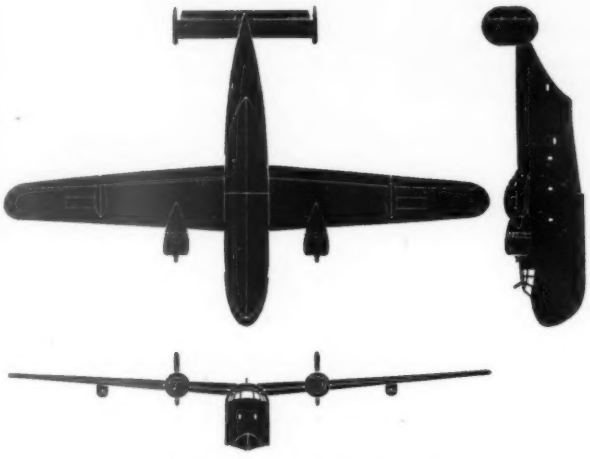
CONSOLIDATED P4Y

Patrol Bomber



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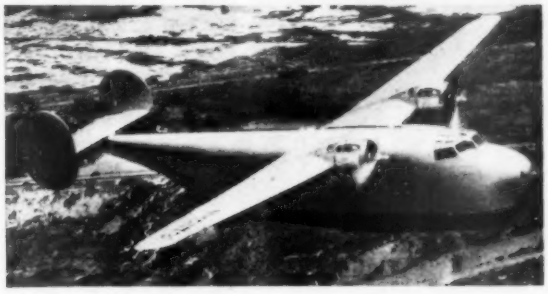
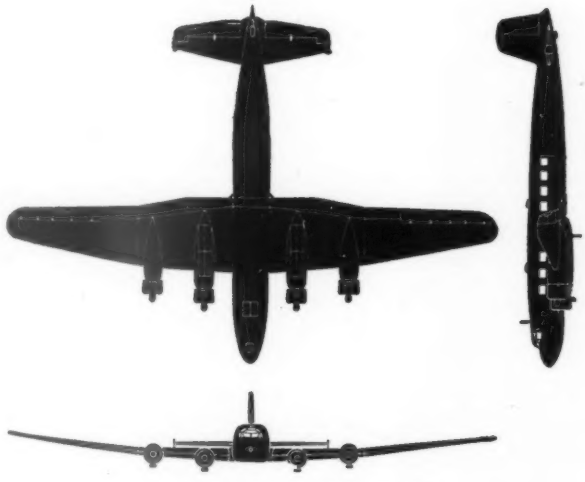


PERTINENT FACTS: Until recently intended to be produced for the Navy as a long-range patrol plane, the P4Y currently is being discussed as a possible transport type The following data deal with the prototype: two 2,000 h.p. engines, performance withheld. Gross weight is approximately 50,000 lbs. Wing span 110 feet, length, 74 ft. ½ in.; height, 25 ft. 1-7/16 in.

WHAT TO LOOK FOR: A huge twin-engined flying boat, the small wing is based on the Davis airfoil as is the wing of the Liberator, which it closely resembles. There are semi-retractable floats out near the wing tips. The boat hull is deep and wide and houses a retractable beaching gear under the trailing edge of the wing. The tail assembly also resembles that of the *Liberator* having twin rudders.

FOCKE-WULF CONDOR

Transport



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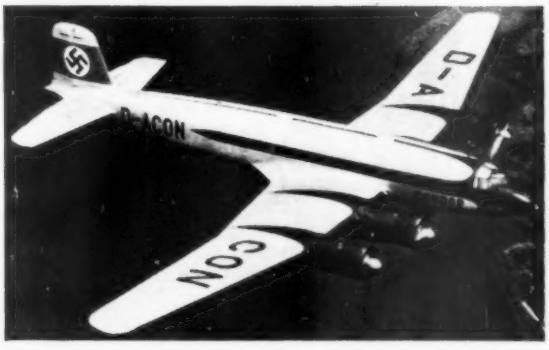
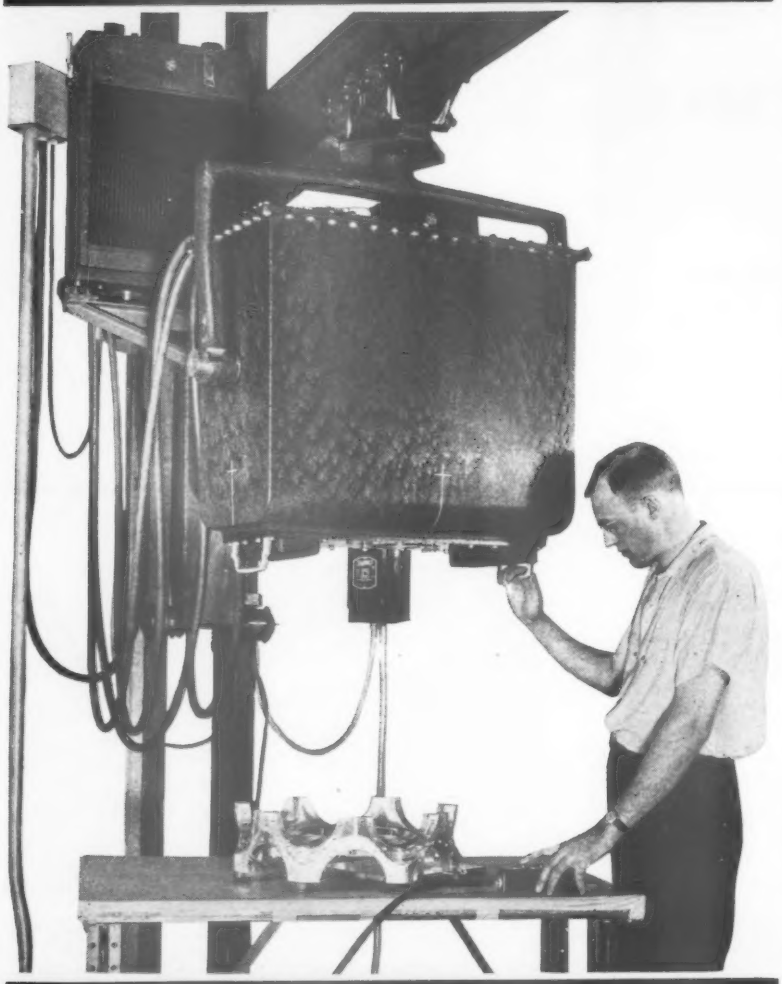


PERTINENT FACTS: Originally an airliner—one of which visited the U. S. on a good-will tour—the *Condor*, or Fw-200B as it is known technically, now is in use as a cargo plane and troop transport. It is powered with four air-cooled 870 h.p. engines, giving it a top speed of 251 m.p.h. at 3,610 feet. Cruising speed at 9,840 ft. is 226 m.p.h. Stalling speed is 69.5 m.p.h. Range at 38,500 lbs. gross weight is 930 miles. Service ceiling is 23,615 feet.

WHAT TO LOOK FOR: With some minor alterations, the *Condor* is identical in appearance to the Focke-Wulf *Kurier;* the latter is an adaptation of the *Condor*. A low-winged monoplane it has moderate to pronounced dihedral, as well as taper in the wing. The center section is particularly interesting for recognition purposes. The fuselage has a slightly humped back and a conventional tail assembly. The main landing wheels retract into the inboard engine nacelles.

FLAW DETECTOR



Technician adjusts an industrial x-ray unit for radiographic check of a crankcase section. This General Electric unit operates at 220,000 volts.

By JOHN L. BACH

General Electric X-Ray Corporation

Hidden flaws in aircraft parts are revealed by the use of industrial x-ray units. Radiographic inspection has become a vital safeguard against structural failures.

X-RAY apparatus, primarily developed to aid in diagnosing human ills, today is turning to indispensable work in speeding production of aircraft engines.

Two industrial x-ray units are used at Buick's Melrose Park plant near Chicago where engines are being built for *Liberators*, biggest American bomber now in action, with a speed of 300 m.p.h. and a range of 3,000 miles.

The use of high voltage x-ray in the aircraft industry, as well as in other war plants, is not a direct offspring of World War II. Today, radiography is standard practice in hundreds of plants—arsenals, steel mills, and shipyards—and its applications range from the routine inspection of finished parts to pure researches in material and processes. The parts themselves vary from small sections of light alloys to complicated assemblies and to heavy boilers, and inches-thick armor plate.

"In the aircraft industry," said Oscar F. Hager, assistant physicist at the Buick plant, "the x-ray has taken the guess work out of building engines. X-ray examinations save thousands of dollars because they catch the failures before they happen. With our two industrial x-ray units—the 220,000-volt and 140,000-volt machines—we are able to nip any defects in material before it reaches the assembly line."

Buick uses its 220,000-volt unit in conjunction with a General Electric bearing mandrel fixture for radiographically inspecting cylindrical bronze aircraft engine bearings. With this unit the total inspection time required to completely x-ray 40 bearings is reduced from approximately five hours to about 10 minutes. In addition, the bearing mandrel provides substantial savings in both film and film handling costs.

Mr. Hager explained that more than 30 steel-back bronze bearings are used in the gears and crankshafts of each engine.

"As soon as the bearings reach our plant," he said, "they undergo x-ray examination. The x-ray films show us whether the steel-bronze bond is perfect; whether there is any segregation of the material; whether there are any cracks in the metal, or whether there is any difference in the density of the material."

Every bearing that Buick puts into an engine must be perfect because bearings are vital to smooth performance, and smooth performance is vital when the big four-engined *Liberators* fly over such targets as the Rumanian oil fields, or Surabaya, the Japs' main base in the Dutch East Indies.

Before the mandrel cassette went into operation in many of the nation's aircraft engine plants, bearings were examined by visual inspection. Success of this method, however, depended largely on the operator's skill. Inspectors, doing the same work day after day, became adept at their jobs, but the results were not as accurate as with the aid of x-ray. Then, too, the visual method did not lend itself to speedy production, so necessary in wartime.

The X-ray reveals flaws in accessory drive shaft of engine invisible to the naked eye. Black dot is an oil hole.

Two methods of x-ray inspection of bearings are accepted, and the bearing fixture, with the proper accessories, can be used for either of these methods.

The first method consists of radiographing the bearing in six exposures, 60° of the total circumference on each exposure. The second method consists of radiographing the entire circumference in a single exposure.

In the first method, which is followed at the Buick plant, the bearings are placed over a suitable lead-covered mandrel on which a non-screen film has been wrapped in a light-tight covering around the entire circumference of the mandrel. The mandrels are then placed on the bearing fixture and rotated to the initial position which, in some cases, is controlled by a push button which starts the motor on the rotating mechanism. A micro switch controlled by a cam stops the rotation. A lead mask interposed between the x-ray source and bearing confined the radiation to a 60° segment of the circumference of the bearing. The first x-ray exposure is then made, and the mandrel automatically rotates 60°. Six successive exposures are thus made, completely radiographing the entire circumference of the bearing on a single film. At the end of the sixth exposure, the jig will not operate further. This prevents making more than one exposure on each 60° segment.

By the second method, the four 19-inch mandrels are rotated through 360° continuously by an electric motor driven unit so that the entire surface of the bearing is exposed to radiation through a narrow slit during the time of the exposure. Thus the film gives the operator a full view of the uniformity of the internal metal content of the bearing. When variation in the thickness of the bearing lining becomes an inspection problem, the continuous rotation method is considered superior.

A set of mandrels must be built for each size of bearing to be examined.

When the x-ray equipment itself is in operation, the tube head of the x-ray unit is centered to the door of the bearing mandrel fixture. The door is provided with four accurately milled apertures or masks which are so arranged that the x-ray beam strikes each mandrel simultaneously.

Buick uses its other x-ray unit—the 140,000-volt machine—for inspecting cylinder heads, crank cases and small aluminum and magnesium parts which are subject to great stress and pressure in the engine's performance.

Mr. Hager declares that industrial x-ray methods have become very valuable to aircraft engineers in developing new parts.

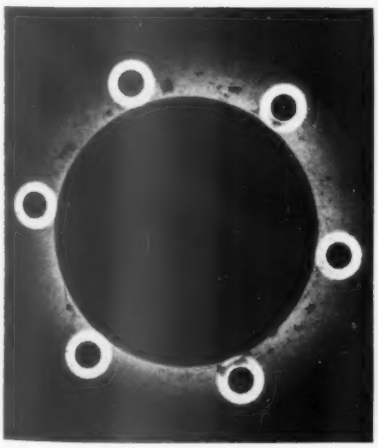
"We also use the x-ray," he said, "to test any new parts and compare the findings with the old. If the new part proves superior in x-ray examinations, naturally it is put into production."

Radiography's widest use in aircraft plants is in examination, providing information on interior structure and conditions; on the existence, location and character of otherwise hidden faults. And, probably of most importance, evidence on film of the acceptability of the part.

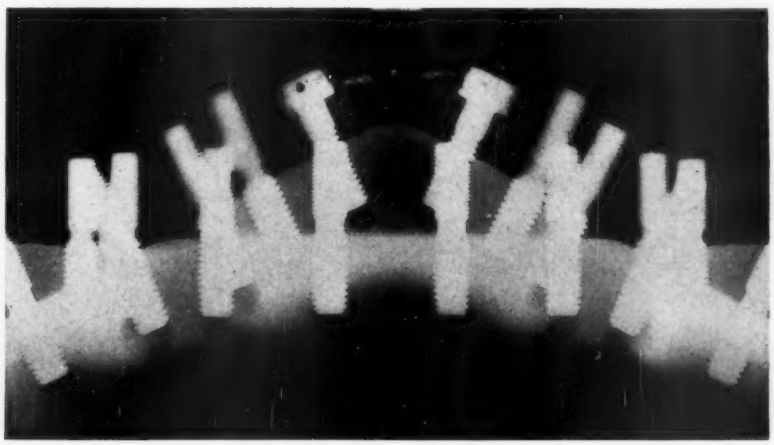
Unlike destructive methods of inspection such as sectioning, or the sawing apart of a piece, radiography provides this information without damage to the piece being inspected.

X-ray units up to 1,000,000 volts are in use in many war plants and even more powerful equipment is in experimental development. New films designed especially for these new requirements of industrial radiography have been made available. END

Heavy porosity and small internal cracks are revealed in engine part.



Radiograph reproduction shows no defects in center crankcase section of airplane engine built by Buick Motor Company. Exact position of studs in crankcase defined.



The 50-passenger Avro York, transport version of RAF Lancaster, is powered with four 1,260 h.p. Merlin engines.

Colorful new NATS insigne has blue background, blue lettering on white wings and gray anchor.

HAVE YOU SEEN?

North American Wirraway (Australian) stands amid wrecked Jap Zeros found lining the runway at Lae.

Curtiss Helldivers (the Army A-25 version) are going to the Royal Australian Air Force from Curtiss's St. Louis, Mo., factory.

Another helicopter design soon to be flown is this designed by Enea Bossi of Higgins Aircraft. This model is two-place.

First Lockheed Constellation turned over to TWA by AAF is shown here being groomed for transcontinental speed flight.

This breath-taking series of photographs from the Pacific theater shows a Jap Kawanishi H-97-I ("Mavis") four-engined patrol bomber shot down in flames. The victor was a U. S. Navy Liberator. Note how flames spread through wing tanks.

I Learned About Flying From That!—No. 53

by GEORGE V. CAESAR

When he saw the sun setting into the Atlantic, the author knew something was mighty wrong.

I THOUGHT that the Atlantic Ocean was a mark big enough to hit without navigation frills. But when I saw the sun setting into it, I knew better!

I'd had about 78 hours and a number of successful short cross-country flights to my credit, some of them under rather difficult conditions considering my inexperience. I'd always paid strict attention to navigation details such as check points, time, ground speed, drift. I suppose I was rather fed-up, also a bit cocky. It was a grotesque performance and I am ashamed of it but it taught me some valuable lessons.

The day was lovely, sunny, cloudless, with a strong persistent ground haze, a perfect example of Indian summer weather. My flight plan was from Al Bennett's Central Jersey airport to Bridgeport, N. J., (near the Delaware); Bridgeport to Atlantic City, then north up the coast and west back to Central Jersey. At Bridgeport I was to meet my wife, little daughter and two grown sons, have a family picnic and then fly my wife and little girl back to Central Jersey airport via Atlantic City. The plane was a light three-place cabin monoplane—a Cub *Cruiser*.

The leg to Bridgeport seemed so simple that I paid little attention to my heading. Near Camden the haze and smoke were so thick that I followed the wrong railroad and spent an uneasy half-hour locating the Bridgeport field. I was more disgusted than worried and this preliminary warning went unheeded.

The family arrived. We had some sightseeing flights, our picnic, and then at two o'clock I took off with my wife and daughter. The magnetic course was 120° for 27 miles, then 143° along what I *thought* was a double-track railroad. Actually it was a four-track road. I carelessly misread the map legend. Navigation toward an ocean only 57 miles away seemed elemental: I was bound to hit it somewhere near the mark. If I lost Atlantic City in the haze I would merely fly north. I didn't much care whether we landed there or not. The flight along the beach was what interested me. I felt thoroughly relaxed and intended to enjoy myself. Aside from engine trouble, how could anything go wrong on such an easy trip in such pleasant weather?

But I soon began to have a few qualms. At 1,000 feet the visibility was never better than five miles, too often nearer two. It lifted and dropped, lifted and dropped.

Laboratory director for the chemical firm of Stein, Hall and Company, New York City, the author learned to fly when 50 years of age. He plans to buy a new plane as soon as the war ends.

Whenever it shut down I was uneasy, but always it lifted again just enough to keep me from turning back. It was one of those days that I now know are peculiarly tricky for inexperienced pilots with slightly enlarged craniums.

Abruptly the pleasant Jersey farmland ended. Vast pine barrens loomed to the east, wicked country for engine failure, particularly unattractive in the soft haze. I couldn't see where the woods ended. If I climbed to the lightplane legal ceiling the ground would be almost indistinguishable. Fifteen hundred feet was about the limit in that visibility—not enough for much of a glide with a dead prop. I edged to the right (southward) then left again, as opportunity offered, trying always to keep within gliding distance of what few open spaces I could find. It wasn't long before this sashaying around lost completely the few check points I'd casually plotted. I was just about to quit and turn north on a straight compass course for home when suddenly I picked up a double-track railroad cutting across my bow and heading about 150° true. "Ah," I thought, "the line to Atlantic City." Uncritically, in my relief, I grabbed at it, too fatuously proud to show the uncertainty I still felt. After all, it seemed no worse now to push on than to retreat ignominiously. The country was bad in all directions. I had plenty of gas, could fly at least an hour more on this heading. Why admit—yet—that I'd botched my navigation? (My wife still thought I was pretty hot.)

The railroad edged still further south. The clearing along its right-of-way was the only possible place to land, and I clung to it. Lonely scattered settlements dotted the edge of salt marshes. An obviously new airport scarred the pines in a white sandy cross. There was no sign of life about it but it was the only cheerful spot in the bleakest landscape I'd ever seen from my own plane. I kept looking back at it like a child leaving his mother, as we flew out across the marshes toward a ghostly hint of open sea.

But what was that gleam of light to the southwest? The haze lifted a little, and there was the sun sinking to a broad expanse of water! The sun settling into the Atlantic? Shades of Columbus! Was my compass, too, bewitched? I have no words to try to describe how I felt at that moment. Mentally, I was a wreck.

There was only one thing to do: land at that airport behind us and restore my sanity and bearings. It looked as vacant as the face of the moon but there was a small settlement nearby. I dragged it carefully, looking it over, trying to find the wind. The N-S runway seemed more finished, but the wind was out of the east and I decided to pass up a crosswind landing on probably soft sand. I set her down as well as I ever will: a glass of water wouldn't have spilled, but I could feel that the E-W runway was very soft. Nevertheless we were rolling sweetly when suddenly there was a lurch to the right and the ship ground-looped viciously. The right inner tube had blown and later I found that the fuselage near the tail was warped.

Thankfully we climbed out and surveyed the twisted tire. It was a little after three o'clock. Generous help arrived from nowhere and in an hour the tube was patched and we were ready to go. It was by then after four, with only an hour and a half of daylight left. We were near Woodbine, N. J., about 22 miles from Cape May! The "Atlantic" with the sun setting into it was the big bight of lower Delaware Bay! It had been utterly impossible for me to believe that we'd wandered that far south. Better visibility would have revealed the outline of the cape and made such psychic upsets and confusion impossible.

Having at last made one correct move, I followed with another. The local flying talent, familiar with the terrain, gently suggested that I stick to sundry railroads. I thanked them and drew a straight line on the map for U.S.-130, to intersect that highway just northeast of Camden. Then I fixed the wind direction accurately, using my watch as a sun compass; estimated its velocity; got out my FLYING calculator and figured my heading and ground speed. All this boiled down to a heading of about 20°, a ground speed of

(*Continued on page 99*)

ARCTIC RESCUE

A lone, half-frozen aviator stranded on a huge iceberg in the North Atlantic! No surface craft near enough to pick him up in time to save him from the biting cold! Then, in the distance, a plane appears—but what good is that? No plane can land on an iceberg!

Luckily we're wrong—for the plane is a Piper Cub L-4 "Grasshopper." It did land, on a flat surface of the giant berg, and it flew the stranded aviator to safety.

The Cub "Grasshopper's" ability to accomplish unusual missions like this clearly illustrates why it is doing such a notable job for Uncle Sam on the fighting fronts of the world. And, when Victory is won, this same ability will be yours in a finer, safer, more economical peacetime Piper Cub.

GET YOUR AVIATION BOOKLET—"Piper Cub . . . In War and In Peace." Full color, 32 pages. Covers history of light plane, Piper Cub planes, coming air age, how to fly. Enclose 10c in stamps or coin for postage-handling. Piper Aircraft Corporation, Department PA24, Lock Haven, Penna.

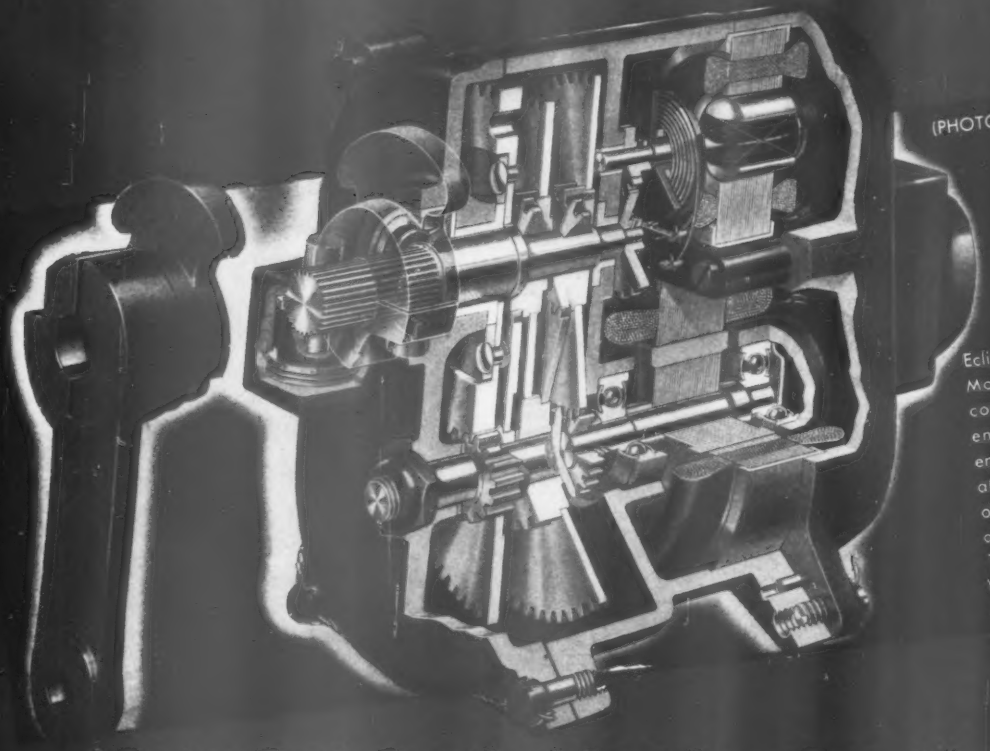
16mm. SOUND FILM—"The Construction of a Light Airplane." For distribution points write: Supervisor, Audio-Visual Aids, Extension Services, Penna. State College, State College, Penna.

PIPER Cub

Points the Way to Wings for All Americans

AIRCRAFT SERVO

Provide Individual, Remote, Coordinated



(PHOTOGRAPH ACTUAL SIZE)

Eclipse Engine-Control Servo Motor provides accurate control of aircraft main engine, assuring efficient engine performance. Rated at 45 inch pounds torque—output shaft speed 5 RPM—arm travel 90°—power input 15 Watts continuous—3[illegible] Watts under load—400 cyc[illegible] AC—weight 2¼ lbs.

Design Check Chart for Eclipse* Servo Control Systems

APPLICATION

Eclipse Servo Control Systems consisting of Servo motors, autosyn transmitters and amplifiers, all interconnected, can be designed to operate from power source of aircraft—now in production or undergoing design—to provide remote, automatic, coordinated control of aircraft main engines, elevators, rudders, flaps, aileron control surfaces, or any other function requiring positive straight line or rotary motion with or against opposition to effect an accurate adjustment.

Consultation with Eclipse engineers on the requirements of your particular Servo Control System application is cordially invited.

PERFORMANCE

Accurate and positive remote adjustments of exacting flight functions can be obtained. Performance ratings of Servo Control Systems depend on specific application.

DESIGN FEATURES

Eclipse Servo Control Systems eliminate mechanical or hydraulic linkage, providing flexibility of application and installation.

Complete synchronization of two or more systems is possible through autosyn controls.

No complicated switching, special relays, potentiometers or motor brushes.

Complete systems are comparatively light weight and current consumption is negligible.

* TRADE MARK OF BENDIX AVIATION CORPORATION

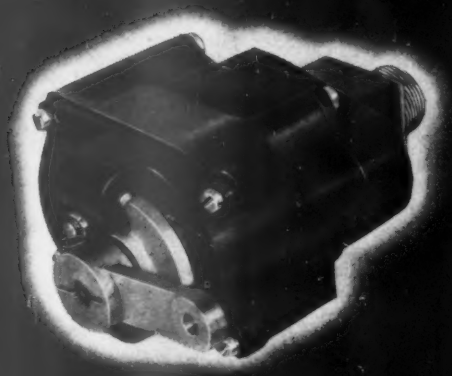
ECLIPSE

Eclipse AVIATION A

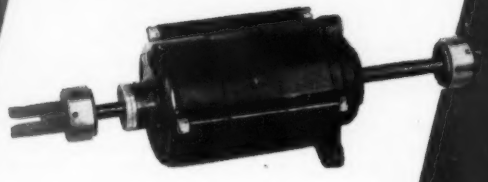
ECLIPSE-PIONEER DIVISION

CONTROL SYSTEMS

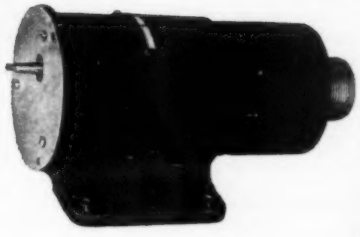
Control of Aircraft Flight Operations



Eclipse Servo Motor for applications requiring coordinated adjustments of aircraft-controlling surfaces.



Eclipse concentric screw-type Servo Motor provides positive straight line motion permitting exacting straight line adjustments.



Eclipse Servo Motor for applications where rotating adjustments are essential.

THE INVISIBLE CREW

Precision Equipment by

Aviation Corporation

ACCESSORIES

Teterboro, New Jersey

The Misuse of Air Power

(*Continued from page 23*)

upon manpower alone but upon firepower.

However, the short range of infantry and artillery fire prevented flexibility of fire except by the movement of men. Napoleon kept an artillery reserve because he could only bring a concentrated artillery fire upon the weakest spot in the enemy's line by galloping up masses of guns to fire on this spot once he had determined it.

With the increase in range of firearms, the day had arrived in the war of 1914-1918 when concentration of fire on the enemy could be had by simply aiming machine guns and artillery on the vital spots without moving the guns.

The terrific concentration possible with modern artillery was demonstrated in the battle south of Soissons, in July, 1918. The First Division was finally stopped after a successful advance for several days. General Sommerall, instead of being content with his gains, concentrated virtually all the artillery of his divisions in front of one infantry brigade, leaving the other infantry brigade without any artillery support. Then, having advanced the first infantry brigade because of this overwhelming artillery support, he left it without any artillery fire and put all his artillery fire in front of the other infantry brigade, enabling it also to advance. In the Argonne he applied the same principle, advancing not brigades but each of his four infantry regiments, one at a time.

The present really terrible concentrations of artillery turned onto any part of the battlefield, and from part to part like a hose being switched about a garden, is a development of this idea, the technical details of which were worked out at the Army Field Artillery School at Fort Sill. Many German prisoners have been known to comment upon the power of this terrific artillery concentration to make them willing to quit.

The guns which produce this concentration, however, must be within relatively few miles of the target.

And here lies the great advantage of aviation. Aviation has a flexibility which far exceeds that of artillery. Where the guns of the artillery must be within a few miles of each other and of the target, planes can be based on airfields hundreds of miles from each other and from the target. This flexibility is the greatest military attribute of aviation.

Artillery, because of its flexibility of fire, made firepower and not the movement of men alone a decisive factor in *tactics.*

Aviation, through its flexibility, has made the concentration of fire in a short period of time both a *tactical* and a *strategical factor* of the highest importance.

The difference at the present time between artillery and aviation is that the artillery is taking the maximum advantage of its flexibility to damage the enemy while aviation is not.

Our own Army regulations state: "The inherent flexibility of air power is its greatest asset. This flexibility makes it possible to employ the whole weight of the available air power against selected areas in turn. Such concentrated use of the air striking force is a battlewinning factor of the first importance."

The tragedy is that we are not using aviation in the way our own regulations provide. It is not being concentrated in battle to support our ground troops and advance them against the enemy. Rather, strategically it is being dissipated and dispersed on scores of separate targets. *Tactically* too much strength is *scattered* over the *rear* of battlefields instead of *all* its force being concentrated on the enemy's infantry, tanks and artillery.

The infantry and tank soldiers advancing on a strong enemy position and the artillery supporting them are not interested in whether their enemy's supply of ammunition and food for tomorrow is being blown up by aviation attacks on the rear. They want their chances of staying alive and unwounded increased by aviation joining the artillery in blowing up the enemy's infantry, tanks and artillery which are shooting at them.

Returning veterans of Tunisia, Sicily and Italy emphasize this.

Each day's newspapers contain accounts of air attacks on German and French ports, factories, and communications from bases in the United Kingdom. They also contain accounts of air attacks in the rear areas of the German ground forces opposing our advance in Italy. They are beginning now to contain accounts of air attacks upon Austrian and Balkan objectives by planes based in Italy.

The map accompanying this article shows:

1. That our air forces in Europe and the Mediterranean theater of war *are not concentrating* on any one enemy area within this theater but are *dispersing their efforts over a number.*

2. That a considerable proportion of the territory occupied by Germany is still out of range of these air forces.

3. That all the German air forces are capable of quickly concentrating their firepower on any part of the front of Fortress Europe which the German high command may desire.

Our air forces are unable to reach all parts of German-held territory because our ground forces *with some help from our air forces* have not yet driven the Germans out of Italy and thus given us the air bases to reach it.

When we landed successfully in North Africa it was a tremendous logistical problem to prepare for the invasion of Sicily and then Italy. Such an enormous undertaking inevitably consumed time. But on the other hand we have now had more than a year to prepare.

Why, in the course of a year, have we not yet put Italy out and obtained air bases in the Valley of the Po River? The answer is that we failed to take the fullest possible advantage of aviation flexibility to support our troops in combat areas. Anyone who has been under fire with and without direct aerial support (the author has experienced both) has only one desire. He wants aviation support, and he wants it operating not only on the enemy's aviation but also on the enemy's infantry, artillery and tanks.

There are two ways in which the time we have taken from the landing in Sicily to reaching our present positions in Italy could have been greatly diminished.

The first was by a strategical concentration of all American air forces able to reach the enemy immediately in front of our invading troops instead, as was actually the case, of only part of those forces being used while others were used at the same time to attack targets within Germany. That a great number of planes could have been so concentrated is proven by the fact that during this same period there were several shuttle attacks, starting in England and flying to North Africa, refueling and taking on ammunition there, and flying back to England. [See "Shuttle Bombing," FLYING, January, 1944.—ED.]

The second was to have all available aviation during the period of attacks by our ground troops concentrate their firepower upon the enemy's infantry, artillery and tanks, leaving the rear areas for attack between battles and the preliminary preparation for battle.

Neither was done.

There can be no doubt of the value of long-range bombardment of enemy industry, communications and ports. There is no reason why industry should not be attacked when there is no fighting going on but, when ground troops are fighting, all available planes should be concentrated in the battle area.

Nor can there be any doubt of the value of aerial attacks on the enemy's rear, upsetting his communications, blowing up his supply and ammunition dumps, his air fields, and in making his troop movements slow and hazardous.

But it should always be remembered that the ability of the air to do these things is limited by the ground made available to it for *airfields gotten by the ground forces defeating the enemy's ground forces in battle.*

Once landed in Italy we had our choice of a quick advance up the peninsula or a slow one to permit the establishment in southern Italy of air bases for long range bombers to attack Austria and the Balkans. The first would have required a heavy concentration of aviation fire on the German ground troops, first to drive them out of their defensive positions and secondly to keep them on the run by not allowing them to settle down in new ones.

Much more air power could have been concentrated for our attacks in the Mediterranean theater. Instead, air facilities which should have been used for tactical support were still being used for strategic bombing of Naples and other cities while our battles raged.

Many of the American long-range

(*Continued on page 94*)

Rapid assembly revolves

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Thus Franklin aircraft engines once again prove beyond a doubt the dependability, the economy and the long life which have made them the choice of so many private plane owners and school operators.
Today Franklin engines are being produced to power the primary trainers of our ally, Brazil, as well as for our own WTS. In addition, Aircooled Motors Corp. is producing several larger Franklin engines, designed for special wartime applications at the request of the Army Air Forces. When the war ends, a complete new line of Franklin engines will be ready to power the finer planes to come.
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HOUDAILLE'S BIG MOMENT

● Shimmy, says Webster, means "to shake, to quiver." But to the pilot of a fast-landing fighter or bomber, a shimmying nose wheel means trouble and plenty of it.

Gone is the trouble now...thanks to the Houdaille-Hydraulic Shimmy Damper. It imposes ever-increasing resistance as shimmying forces mount in magnitude, yet offers little hindrance to slow wheel movements encountered in steering.

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AIRCRAFT OWNERS AND PILOTS ASSOCIATION

AOPA NEWS

The Aircraft Owners and Pilots Association (AOPA) with National Service Office located in the Carpenters Bldg., Washington, and Registrar's Office in the Michigan Square Bldg., Chicago, is a non-profit organization composed exclusively of pilots. It looks after the pilot's best interests in all phases of aviation and helps individual pilots with their individual problems. The AOPA operates with a full-time professional staff and is the largest group of civilian pilots in the world. This column is edited by the Aircraft Owners and Pilots Association and opinions contained in it are not necessarily those of FLYING. A special Bulletin is sent each month to all registered AOPA pilots and also confidential memorandums from AOPA's Washington staff are sent members from time to time.

IN ANSWER to many inquiries we are setting forth below AOPA's program of services for pilots. Since 1939, AOPA's objective has been to make non-scheduled flying (a) more useful, (b) safer, (c) less expensive, and (d) more fun. AOPA aims to be to the pilot what auto clubs were to motorists, especially when motoring was new. AOPA is a non-profit pilots' organization. *Membership is open to pilots only.*

AOPA now renders most of the following services to pilots and will render the remainder as soon as conditions permit. Planned activities are marked with an asterisk.

1. Pilot Advisory Service. You can write AOPA: "How do I get a radio license?" . . . "Where can I get a job as a . . . ?" . . . "How do I get a . . . license renewed?" . . . "Can you find what happened to my application sent to CAA?" . . . "Where can I buy (or sell) a used plane?" . . . "Where and when can I see the nearest CAA inspector?" . . . "What WPB rating am I entitled to?" . . . or any of a thousand other requests, and you usually will receive prompt, definite, "on the nose" assistance. Often our Washington representative can, by a personal visit to the right man, break red tape and settle something for you in one hour that would otherwise annoy you for months. Members have a *personal* representative working full time for them in Washington.

2. Arrange Special Flights. (Suspended for war period). As in the past, AOPA will arrange special vacation flights, breakfast flights, etc., at various points throughout the U. S. Food, other facilities, and entertainment will be prearranged at special rates.

3. Tow-in and Repair. AOPA has arranged for transportation of crack-ups in especially constructed vehicles designed for this purpose only.

4. Travel Bureau. (Partially suspended for war period) Foreign maps, information, papers of admission, etc., will be available to pilots wishing the thrill of flying through Mexico, Guatemala, Alaska, etc., or who wish to rent a plane abroad for a flying vacation.

5. License Service. AOPA's Washington office can usually get prompt results where red tape has caused delays.

6. Legal Aid. AOPA has access to legal advice specializing on aviation matters. In the past some unfair suits against pilots have been promptly scuttled after AOPA entered on the pilot's side. If bad luck ever catches up with you this service "in need" will be appreciated.

7. Driv-Ur-Self. AOPA members get a reduced rate on Driv-Ur-Self automobiles throughout the U. S. AOPA pilots have special wire reservation privileges. One use of this per year may save your entire membership fee.

8. AOPA "Pilot." AOPA writes, prints, and sends to each member each month the latest information of particular interest to pilots. This pamphlet, the "AOPA *Pilot*," is separately bound into special AOPA Editions of one of the best aviation magazines in the U. S. and mailed monthly to AOPA members. The *Pilot* and the magazine are together equal (at normal subscription rates) to the yearly AOPA membership fee. All other AOPA services to you may be considered as "gravy."

9. "Cockpit Clatter." When some really hot piece of news comes along that every pilot should have without a day's delay, AOPA writes a special newsletter (called "Cockpit Clatter") and mails it direct to each member.

***10. Airport Directory and Radio Guide.** Every pilot, when touring, needs an Airport Guide. From it he can tell where the nearest airport is to his landing field, what services are available, length of runways, radio and lighting equipment, etc.

***11. Check Charts, Etc.** AOPA will have available for members special check charts for engine and plane, special trip log sheets, and other special printed forms that pilots need.

12. Legislative Branch. AOPA constantly advises those who write laws and make rules. AOPA suggests changes to make proposed rulings more practical and less onerous. Occasionally AOPA puts up a bitter fight against extremely bad proposals (such, for instance, as high and unjust landing fees). This work *must* go on, as city and state bodies, in particular, are likely to work up highly damaging regulations.

***13. Insurance.** AOPA will see that insurance rates on pilots and planes are offered at the absolute minimum rate justified by losses. Some rates in the past have been entirely too high and have constituted a major expense to the pilot.

***14. Test and Rate Equipment.** AOPA will impartially test planes and accessories and members may obtain unbiased data as to the speed of a plane, the rate of climb loaded, etc. Reputable manufacturers sometimes suffer because extravagantly incorrect claims of speed, etc., are claimed by competitors. The pilot has been in the middle. Reputable testing laboratories will be utilized.

15. Remove Airport Obstructions. "Bury the wires and not the pilot." AOPA will continue to assist in having obstructions removed and in preventing the erection of proposed obstructions.

16. Hotel Discounts. AOPA-designated hotels offer special privileges to AOPA members. The savings to the pilot frequently pay his AOPA dues many times over.

***17. Rated Airports.** AOPA will list 4-star and 3-star airports that have particularly good equipment and service for non-scheduled flying.

18. Airhavens. Attractive homes built around an attractive landing field—an Airhaven. AOPA offers plans for Airhavens and is urging people to build them.

19. Employment Service. If you want a job in aviation, ask AOPA where to find one. Many pilots have already used this service. If you seek personnel, consult AOPA.

***20. Quicker A.T.C.** Among the many improvements in CAA the AOPA will try to bring about is the quicker granting of an A.T.C. ("approved type certificate"), especially to a good newly-developed plane when there is not a lot of money back of it. A.T.C.'s have taken too long and been too expensive.

21. Used Plane Sales. If you wish to buy or sell a used plane, send details to AOPA. Many persons have been amazed at the quick action they received.

22. Sporthavens. There are in the U. S. a few delightful "Sporthavens"—vacation spots with accompanying airports. Many more are needed and AOPA will continue to promote landing fields in state parks and near other vacation grounds.

23. More Airports. This will be a continuous battle year in and year out. AOPA will continue the successful fight for more landing strips, airports and seaplane bases near city centers.

24. Personal Insignia. The AOPA lapel wings mean to everyone who sees them, "That man is a *pilot*." Each AOPA member receives this attractive and unusually expensive lapel pin; also other insignia for plane, car and pocketbook. These are free to members as are the newsletter and the two monthly publications that are bound together. The above are together worth more than the membership fee. The other services, discounts, etc., are all net profit to the member.

Pilots desiring information as to how they may participate in AOPA's program are cordially invited to address their inquiries to the AOPA National Service Office, 1003 K Street, N. W., Washington 1, D. C. END

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What a record!

29,764,025 miles in 2½ years.

This outstanding safety record established by Embry Riddle's Carlstrom Field Arcadia, Florida which is operated under the supervision of the U. S. Army Air Forces Training Command, was made with trainers powered by Continental Red Seal Engines.

The record speaks for itself.

POWER TO WIN

Your Dollars are Power, too . . . Buy War Bonds

Continental Motors Corporation

Aircraft Engine Division

MUSKEGON, MICHIGAN

JOHN PAUL RIDDLE, *President*

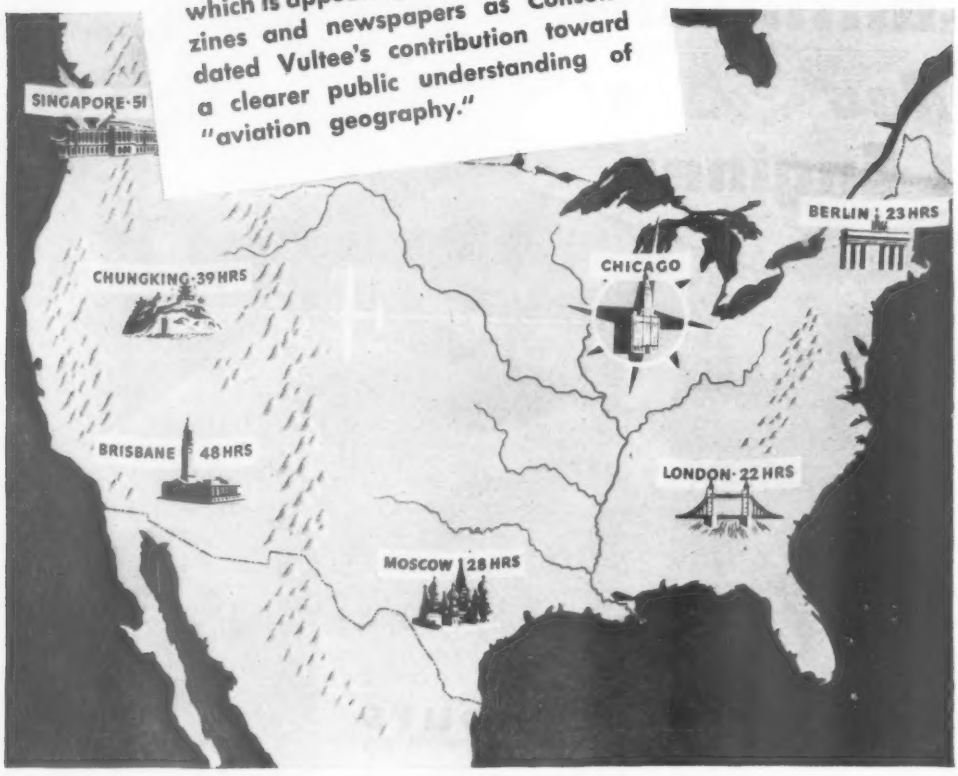
EMBRY-RIDDLE SCHOOL OF AVIATION

Miami, Florida

He and his organization built this, the largest aviation school in the world. For more than twenty years John Paul Riddle has been fundamentally thorough — not only in self-training but in the training of thousands of pilots whose achievements in the air reflect the complete instruction that is a "must" at Embry-Riddle.

Awarded to the Detroit and Muskegon Plants of Continental Motors Corporation for High Achievement.

This advertisement is one of a series which is appearing in national magazines and newspapers as Consolidated Vultee's contribution toward a clearer public understanding of "aviation geography."



What's Chungking doing in Nevada?

THIS, YOU WILL SAY, is a strange-looking map of the U.S.A.

There's Chungking, China, right where you'd expect to find Elko, Nevada.

But we put it there to remind you that you can fly from Chicago to Chungking in 39 hours' elapsed time —about the same time it takes to travel from Chicago to Elko, Nevada, by train.

And that's why we put Moscow, Russia, where San Antonio, Texas, ought to be — and Singapore up near Seattle, Washington.

The number of hours shown over each of these foreign cities represents the elapsed time by air from Chicago to that foreign city. Its location on the map shows the approximate distance you could travel in the U.S. by train in the same length of time.

Perhaps you hadn't thought of the world as being so small. But it is. Today, because of the long-range plane, *no spot on earth is more than 60 hours' flying time from your local airport.*

No longer, in a world shrunk so small, can there be such a thing as a hermit nation. Not when the Atlantic can be spanned in 372 minutes, and the broad Pacific in only 35 hours.

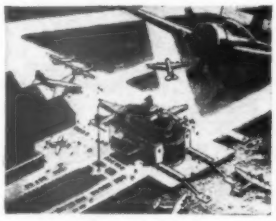
As a nation, we didn't fully understand this, at first. But when we did become aware of it, we quickly recognized the need for speeding the production of vast numbers of military aircraft, and training the personnel to fly, fight, and maintain them.

This has been done — is still being done. And mastery of the air — which was not ours to begin with — is now helping to change the once-desperate hope of ultimate victory into a certainty.

After Victory, when we set about the task of *securing* our freedom and

CONSOLIDATED VULTEE AIRCRAFT

a lasting peace, the plane will take its rightful place as a tremendously *constructive* force, welding the peoples of the earth together in friendly trade and intercourse and mutual understanding.



A nation on wings — *In 1940, there were less than 100 major airports in the U.S. By the end of this year there will be at least 865, not counting military airdromes, all capable of handling even the biggest planes now flying. In addition, there will be well over 2000 smaller landing fields.*

The 4-engine, long-range Liberator bomber *carries a* heavier *bomb load* farther *and* faster *than any other U.S. bomber in action against the enemy. Those operating from U.S. and British bases on anti-submarine patrol have been nicknamed "V.L.R."* (very long range) *Liberators. Fully loaded with depth bombs, they fly 2000 miles or more, have sunk subs as far as 1000 miles out in the Atlantic. Because of their extremely long range, Liberators were chosen to carry out the devastating raid on the Ploesti oil refineries in Rumania.*

CONSOLIDATED VULTEE AIRCRAFT CORPORATION

San Diego, Calif. • Vultee Field, Calif.
Fort Worth, Texas • New Orleans, La.
Nashville, Tenn. • Wayne, Mich.
Allentown, Pa. • Tucson, Ariz.
Elizabeth City, N. C. • Louisville, Ky.
Dearborn, Mich. • Miami, Fla.
Member, Aircraft War Production Council

QUICK FACTS FOR AIR-MINDED READERS

The long-range Army Liberator bomber is now being built by Ford, Douglas, and North American, as well as by its designers, Consolidated Vultee. Sharing the blueprints of a great weapon for Victory with other manufacturers is the American way of waging a war.

The tough, bullet-fast Vengeance dive bomber is a Consolidated Vultee combat plane. Powered by a 2000 horsepower engine, and with hydraulic dive brakes for perfect control when streaking earthward toward its target, this deadly Army plane is giving a superb account of itself on our global battlefronts.

Well over 40% of the tens of thousands of workers in the Consolidated Vultee plants are women. Many of them were teachers, housewives, salesgirls — people who never worked before in an office or plant. But now they are skilled aircraft builders, doing their part to hasten the end of the war.

• • •

More than 10,000 subcontractors and suppliers are pitching in and working 'round the clock to help us put more and more Liberator bombers into the hands of Army and Navy pilots.

No spot on earth is more than 60 hours' flying time from your local airport.

Trans-oceanic flying transport — *Swarms of Liberator Express transport planes — workhorse version of the 4-engine, long-range Liberator bomber — are flying America's globe-girdling supply lines, carrying military equipment and personnel. "Payload" capacity: up to 10 tons. One Liberator Express operating for Consairway — Consolidated Vultee's foreign service transport line for the Air Transport Command — has already flown 31 round trips to Australia.*

FREE: Consolidated Vultee is eager to make whatever contribution it can toward a clearer understanding of today's new global geography.

The well-known cartographer, Richard Edes Harrison, has worked with us in the preparation of a 32-page booklet entitled "MAPS — and how to understand them." This booklet is now available and will gladly be sent free on request. Simply fill out the coupon at the right.

Consolidated Vultee Aircraft Corp.
P. O. Box 157, New York, N. Y.

Please send me a free copy of the 32-page booklet, "MAPS — and how to understand them."

Name _____

Address _____

_____

LIBERATOR (4-engine bomber) — CORONADO, CATALINA, (patrol bombers) — LIBERATOR EXPRESS (transport) — VALIANT (basic trainer) — VENGEANCE (dive bomber) — SENTINEL ("Flying Jeep") — RELIANT (navigational trainer)

(*Continued from page* 86)

bombers based in England could have been used for tactical support. *The advantage of the long-range bomber is that it can fly from an airfield located in the country from which the attack starts.* For instance, in an invasion of the Continent across the North Sea and the English Channel, the long-range bombers supporting the attack can fly from airfields long in existence in Britain. The same is true of long-range bombers based in Africa. Where the fighting is not within range of land-based fighter planes but within range of the sea coast, carrier-based fighters can be used.

In operating across water where sea transport plays a very important part, as was the case in the Sicilian campaign and is now the case in the Italian campaign, and will be the case in any Balkan campaign or the establishment of a second front in Western Europe, there is another very important point.

It is that you cannot load more tonnage in the ships available than they have been designed to carry. Therefore, it is very important to *apportion that tonnage so that when combat is going on with the enemy at the end of the voyage there will be available the maximum combat power to bring against him in battle.*

The establishment of air bases is not only a question of the materiel needed for maintaining planes but also the considerable number of men on the ground to keep an air base going. Furthermore, all these men have to be fed, clothed, administered and disciplined, and the medical corps personnel provided.

Therefore, if the aviation support does not have to be transported by ship but can fly in from bases maintained on the other side of the water, the same amount of tonnage can transport and maintain a far greater number of infantry, artillery and tanks.

All the battlefields in Sicily and those up to date in Italy are within reach of air bases in North Africa.

However, to reach German factories in the neighborhood of Vienna and other points in the Valley of the Danube it is necessary to have bases established in Italy, and such bases necessitate the use of tonnage which otherwise could be used to increase the proportion of our artillery, infantry and tanks fighting the Germans.

Each day's newspapers contain accounts of air attacks on German and French ports, factories and communications from bases in the United Kingdom. They also contain accounts of air attacks in the rear areas of the German ground forces opposing our advance in Italy. They are beginning now to contain accounts of air attacks upon Austrian and Balkan objectives carried out by planes based in Italy.

In consequence of choosing long-range strategic bombing we are scattering bombs over Austria and the Balkans while in Italy we have not yet captured Rome!

Had we chosen to use the flexibility of air power to concentrate it in direct support of our ground troops, our aviation today would have bases in the Po Valley from which to bomb Germany strategically while we are preparing the general assault on Fortress Europe.

Army regulations state: "Land power (the American terminology has always been 'ground troops' while the British have referred to 'land power') and air power are co-equal and interdependent forces. Neither is an auxiliary of the other."

The fact is, however, that the manner in which air power has been used has reduced ground troops to an auxiliary position. This not only prolongs the war but is also to the detriment of the fullest use of air power. Otherwise our aviation today would be in a vastly stronger position by reason of the land bases we would have won for it.

This is the fifth year since the Spanish War. The last part of that war clearly demonstrated the importance of tactical support from the air. One of the reasons the Loyalists lost was because their ground troops did not get such direct support while the Nationalists always got such support.

Our own Army regulations show clearly that adequate air support to the ground troops is not to come even from the tactical air forces. They state:

"First priority of missions of the tactical air force is to gain the necessary degree of air superiority.

"Second priority, to prevent the movement of hostile troops and supplies into the theater of operations or within the theater.

"Third priority, to participate in a combined effort of the air and ground forces in the battle area to gain objectives on the immediate front of the ground forces."

That is exactly the trouble. Granted, the first priority—obtain air superiority—is correct if it can be obtained, it is only acceptable up to the time real fighting begins. When that happens, *support of ground troops in battle areas, now given third priority, should be first.*

Failure to have sufficient ground forces at the front, as is true in Italy today, has been the cause of every United Nations defeat since the war began.

Contrasting the situation in 1917, when we entered the war, with that of today, shows this:

In 1917, when the United States entered the war the Allies had Germany, Austria-Hungary and Bulgaria shut up in a relatively small part of Europe by comparison with the enormous proportion of that continent held by the Germans today. On the eastern side, while Russia had been pushed back east it was not as far east as the line on which the Russians and Germans are fighting today. Elsewhere, Germany and her allies were hardly out of their own territory. The Scandinavian countries, Denmark and Holland were all neutral and unoccupied by the Germans. While most of Belgium was occupied, only part of north and northeastern France were in German hands. Italy held roughly the crest of the Alps. In the Balkans the Allies held the line across southern Albania and northern Greece, stretching from the Adriatic to the Aegean Sea.

Had aviation existed on the scale of today we could easily have bombed all of the interior of Germany and her allies.

When the war started in 1939, Belgium, Britain and France held a better position on the Western Front than the Allies held in 1917 and 1918. Holland, in a state of armed neutrality, furnished a splendid opportunity to flank the German positions once an attack was launched.

Later, when there was every indication that Germany intended to invade and occupy Norway, the opportunity existed to occupy it first.

Had we taken advantage of this, the British and French aviation would have had airfields from Norway in the north through Holland, Belgium and northern France to the Swiss frontier.

Why did we fail to take advantage of this splendid opportunity?

The answer is simple. In none of these places did the United Nations have enough ground troops to keep the Germans out and give French and British aviation a chance to operate. It is true that the Germans had superior air power, but that is not the reason. There are two reasons: First, in all these countries, the Germans had a vastly superior number of ground troops when they invaded on the ground.

The second reason is that they used their aviation not to bomb long distances in the rear, in accordance with Douhet's theory, but strategically to prepare the attack for the ground troops and tactically to give direct support to the German ground troops by attacking the enemy's infantry, tanks and artillery on the battlefield.

When Yugoslavia came in and Greece, which had been fighting the Italians for some time, needed help against the Germans advancing through Yugoslavia, why did the British sent across from Egypt fail to hold the old 1917 line in front of Saloniki, which they had reached before the Germans attacked them?

The answer is the same as in Norway, Holland, Belgium and France—insufficient ground troops to meet the German attack of ground troops constantly supported in combat by the German aviation.

The German aviation, with previously prepared airfields, was able to concentrate against the British. British aviation, lacking airfields in Greece, was at a serious disadvantage.

Had the British sent help to the Greeks immediately they entered the war, they could have established themselves firmly in the old line through southern Albania and across northern Greece, while their aviation would have had plenty of time to establish themselves in Greece.

Why wasn't this done?

It was not done for the simple reason that the British lacked sufficient ground troops both to carry on the campaign in Libya and bring help to the Greeks. The help they finally sent to Greece so weakened the British garrison in Libya that it was lost to the Axis.

(*Continued on page* 158)

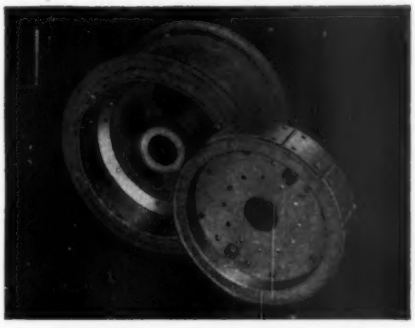
HERE OF ALL PLACES...SAFETY COMES FIRST!

Safety-Equipped with GENERAL AVIATION PRODUCTS

Operating largely from makeshift runways and rough, emergency landing areas . . . in good and bad weather in every climate . . . The HOWARD NIGHTINGALE efficiently performs its pick-up and delivery of the most precious cargo in the world!

A tough job . . . but compensating for operational difficulties—in addition to rugged, Howard design—are GENERAL AVIATION PRODUCTS . . . *known 'round the world for quality and safety!*

General's famous Top-Quality is to be found today in *all* General Aviation Products . . . in General's Main Landing Tires, Tubes, Wheels and Brakes . . . in General Tail Wheels, Tires and Tubes . . . and in the extruded and molded rubber aviation parts made by General . . . gaskets, grommets, brake boots, pump diaphragms, wing walk treads, enclosure seals, and *hundreds* of other parts.



The GENERAL 9 x 12 Expander Tube Brake & Wheel—*partially assembled.*

- ★ **Bi-Metallic Drum affords rapid heat transfer from braking surface**
- ★ **Heat control eliminates drum distortion . . . brake "fade"**
- ★ **Brake and wheel combination offers lighter weight . . . greater payload . . . longer service life!**

Available Immediately for the Size 7.50 x 10 Wheel and Brake Unit.

THE GENERAL TIRE & RUBBER CO.
Aviation Division • Akron, Ohio

The GENERAL AIRPLANE TIRE

A message for you . . . from 1953

(Today, John Jones is just an average American, wrestling with all the doubts and worries and problems that beset every one of us right now. But let's skip ahead 10 years. Let's look at John Jones then—*and listen to him . . .)*

"SOMETIMES I feel so good it almost scares me. "This house—I wouldn't swap a shingle off its roof for any other house on earth. This little valley, with the pond down in the hollow at the back, is the spot I like best in all the world.

"And they're mine. I own 'em. Nobody can take 'em away from me.

"I've got a little money coming in, regularly. Not much—but enough. And I tell you, when you can go to bed every night with nothing on your mind except the fun you're going to have tomorrow—that's as near Heaven as a man gets on this earth!

"It wasn't always so.

"Back in '43—that was our second year of war, when we were really getting into it—I needed cash. Taxes were tough, and then Ellen got sick. Like most everybody else, I was buying War Bonds through the Payroll Plan—and I figured on cashing some of them in. But sick as she was, it was Ellen who talked me out of it.

"'Don't do it, John!' she said. '*Please* don't! For the first time in our lives, we're really saving money. It's *wonderful* to know that every single payday we have *more* money put aside! John, if we can only keep up this saving, think what it can mean! Maybe someday you won't have to work. Maybe we can own a home. And oh, how good it would feel to know that we need never worry about money when we're old!'

"Well, even after she got better, I stayed away from the weekly poker game—quit dropping a little cash at the hot spots now and then—gave up some of the things a man feels he has a right to. We made clothes do—cut out fancy foods. We didn't have as much fun for a while but we paid our taxes and the doctor and—we didn't touch the War Bonds.

"We didn't touch the War Bonds then, or any other time. And I know this: The world wouldn't be such a swell place today if we had!"

The Treasury Department acknowledges with appreciation the publication of this advertisement by

ZIFF-DAVIS PUBLISHING COMPANY

"Feeder" Factories

(Continued from page 27)

ping machines, swaging machines, soldering irons and the workers' own miscellaneous hand tools. Just about the bulkiest equipment at the shops are bandsaws, hydraulic rivet presses and buffer machines.

In contrast to the headaches of employment officials scraping the oft-scoured bottom of the labor supply barrel in San Diego, recruiting of workers has been a pleasure in the feeder shop towns.

"We learned that there were hundreds of women in these small towns who were just aching for a chance to do something toward the war effort," explained a Convair executive, "yet for some reason they had not yet gone to work in any of the big factories. Some were reluctant to leave their homes. Others had retired and had little incentive to move away from their quiet surroundings to work in a booming war industry city.

"Wives of service men who followed them to the coast and settled down to wait their return from overseas duty, such as many of the women in Laguna Beach, readily seized a means of self-support and an escape from the boredom of idleness. In Santa Ana, wives of men at the nearby giant Army air base form a large percentage of the employees in the three shops there."

Daughters and wives of farmers, shopkeepers, the neighborhood doctor or lawyer, and of men in the armed forces are relied on to keep the feeder shops functioning. Thus, the economic structure of each community, and its adjacent farm labor requirements, are not being tampered with. And since these women as a rule already were in the community when the feeder shop was established, its presence has created no new housing and transportation problems.

The *esprit de corps* in the shops is amazing. It reflects small-town enthusiasms and group pride that will not be found in huge factories in which a worker transplanted from his native environment hundreds or thousands of miles away feels himself a mere automaton in a complex machine.

At Laguna Beach, for instance, the two shifts have formed day and night clubs between which a friendly spirit of rivalry exists for better production records.

A large percentage of the women workers don't need the money. At Coronado, Mrs. John H. Towers, wife of the vice admiral in command of Navy aviation at Pearl Harbor headquarters, has charge of recruiting the personnel. Ranking Navy and Marine Corps officers' wives sort rivets alongside those whose husbands' uniforms can show little more distinction than a sergeant's chevrons.

Seven electric assemblers at Laguna Beach have banded together into a group known as the "Retreads." Each served in World War I, and leaped at the opportunity to substitute factory work for an existence of gardening and getting suntanned on the beach. Several were nurses overseas, others worked in munitions plants in the last conflict. Like many of their fellow workers, their hair betrays some gray.

"We fought and worked to make the world safe for democracy once," says Maude Shanafelt, one of the septet. "Now we're back on the industrial firing line to guarantee that in the future there won't have to be need for any more 'Retreads.'"

Perplexed by labor supply troubles at home, Convair officials will break into grins whenever the feeder shop subject is brought up. They believe that they're the first to attempt this method of controlled sub-contracting on such an extensive scale.

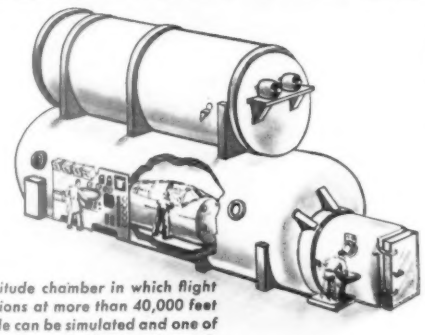
"You bet we're enthused over the feeder shops," says Works Manager Bowling. "How else could you get another 1,700 persons out of a hat? END

Last Year's Bonds Got Us Started

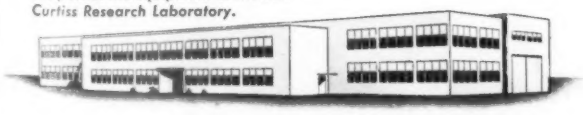
THIS YEAR'S BONDS ARE TO WIN!

VAN SCOTEA

KEEP YOUR EYE ON *Tomorrow's Horizons*



An altitude chamber in which flight conditions at more than 40,000 feet altitude can be simulated and one of the world's most modern wind tunnels are part of the equipment at the new Curtiss Research Laboratory.

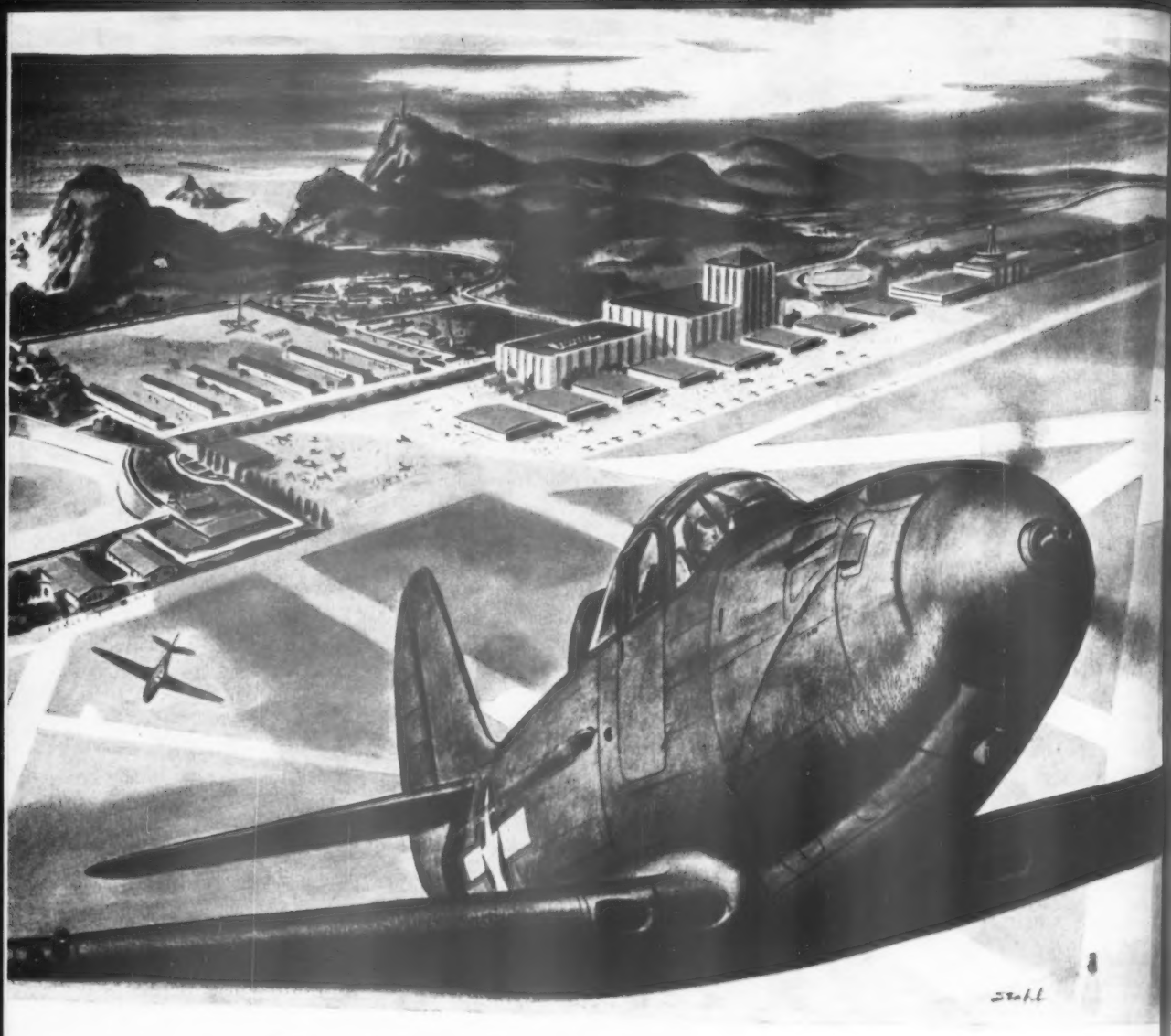


Beyond measure are the engineering advances, the improvements in manufacturing methods, which are the product of Curtiss-Wright's vast wartime program. When war is done, this rich experience will give the world safer, speedier, more luxurious airliners—swifter, more economical cargo carriers.

LOOK TO THE SKY, AMERICA!

CURTISS-WRIGHT
Corporation
AIRPLANE DIVISION
BUFFALO • COLUMBUS • ST. LOUIS • LOUISVILLE

MEMBER, AIRCRAFT WAR PRODUCTION COUNCIL, EAST COAST, INC.



"SKYTOWN" U.S.A.
pop: 2,000,000

Very soon now, there'll be well over 2,000,000 men in the U. S. Army Air Forces.

Flight is their business.

War has taught them the machines, the techniques, the language of flight. They recognize no impassable barriers of land or sea.

There's many a man among these two million who pilots the U. S. Army Bell Airacobra. In his single engine fighter, he can be 20,000 feet in the sky—seconds after he leaves the earth. Sixty minutes later he can be more than 400 miles away ... blasting out a pattern of victory with machine gun bullets and cannon shells.

It's as if he had moved to a strange new city (Skytown, U. S. A.) and adopted a new way of life.

MEMBER AIRCRAFT WAR PRODUCTION COUNCIL—EAST COAST, INC.

MAKE NO EARTHBOUND PLANS FOR THESE 2,000,000! After the war, they—and you—will fly. You'll fly in superior planes of peace because this war has taught *us* some lessons, too. How to break with precedent in designing aircraft to do specific jobs. How to pioneer better, faster, less costly methods of mass production. © Bell Aircraft Corporation, Buffalo and Niagara Falls, New York.

BELL *Aircraft*

AIRACOBRAS for victory—future planes for peace

BUY WAR BONDS AND SPEED VICTORY

The Elements of 'Celestial'

(*Continued from page 34*)

rangement of the tables and diagrams and follow through the problems given.

The navigation accomplished in a flight will now be given as it is actually done. The "sights" are worked by H. O. 214 using the Navigation Note Book and the Mark II Plotter. The D. R. data is arranged at the top of the page, with the solutions for lines of position on the bottom half of the page.

Referring to the vertical form:

GCT is Greenwich civil time as read from a second-setting watch. GHA is Greenwich hour angle taken from the air almanac for the proper GCT and date. "Corr" is the correction of GHA for odd minutes of GCT. "(A)" is the assumed longitude near the D. R. position, so chosen as to produce a LHA, or Local hour angle, as a whole degree. LHA is the angle between the assumed longitude of the observer, and the longitude of the geographical position (G. P.) of the body. "Dec." or declination, is the latitude of the body's G. P. and is found in the almanac with G. H. A. "Lat" or latitude, is the whole degree of latitude nearest the observer's D. R. latitude.

With the arguments LHA, Dec and Lat, the values of Ht, tabulated altitude and azimuth, are taken from H. O. 214. "d" is a correction for odd minutes of declination. Hc is the computed altitude which is compared with the observed altitude, Ho, to obtain the altitude difference, "a." The latter is laid off from the assumed position of the observer along the azimuth line, toward the body if Ho is greater than Hc, and away if Ho is smaller than Hc. Through the point thus found, the line of position is drawn at right angles to the azimuth of the body.

This is a short incomplete explanation of practical celestial navigation, but will show the simplicity of the method. Lines of position are advanced or combined with position lines found by radio or by bearings on terrestial objects. END

I Learned About Flying . . .

(*Continued from page 82*)

about 90 m.p.h., and a plus drift, variations in which were of small concern since the direction was inland.

We took-off at 4:20 p.m. on what proved to be the excellent N-S runway. I watched my navigation meticulously and hit old familiar 130 exactly where I'd planned. There was still enough daylight remaining to get up to Central Jersey. As the shadows lengthened, we settled down to 500 feet. We got in "under the line," and were we happy!

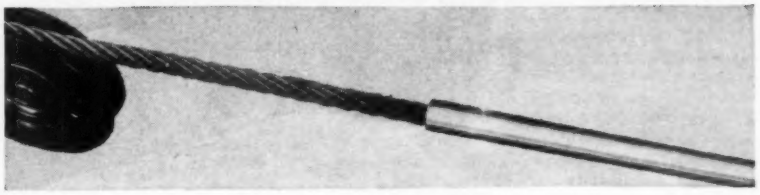
What I learned about flying from that day's work, was:

(1) Always navigate over unfamiliar terrain.

(2) Always navigate, anyhow.

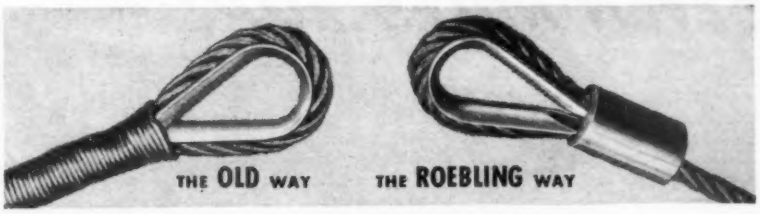
(3) Don't tackle long flights when there is a strong ground haze—unless you have an instrument rating (and instruments). END

ANSWERS
TO THREE PROBLEMS . . .



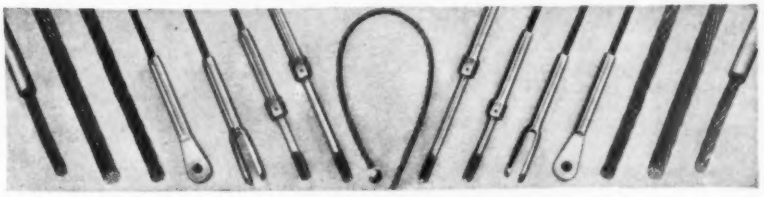
1 THE PROBLEM OF CORD STRETCH

and the related problem of thermal changes . . . An answer: "Lock-Clad" Control Cord, conceived by Lockheed, developed and manufactured by Roebling. Its swaged dural sheath reduces load stretch, brings coefficient of expansion to a point more closely approaching that of the dural airframe.



2 THE PROBLEM OF SPLICING CORD ASSEMBLIES

. . . An answer: This new Roebling sleeve, which eliminates waste of cord, and the need for skilled splicers.



3 THE PROBLEM OF PRODUCTION LAGS

. . . An answer: Complete assemblies of cord and swaged terminals from Roebling. A complete range of types and sizes of Roebling Aircord and Terminals to suit your purpose.

Aircord Division
JOHN A. ROEBLING'S SONS COMPANY
TRENTON 2, NEW JERSEY • *Branches and Warehouses in Principal Cities*

JR ROEBLING
ROEBLING
Aircraft Wires and Fittings

PACEMAKER IN WIRE PRODUCTS

Wire Rope, Strand, Fittings Division
Aircord Division
Suspension Bridge and Cableways Division
Electrical Wire Division
Round, Flat Wire Division
Woven Wire Fabric Division

Appointment at Seven ... SEVEN MILES ... UP!

Seven miles or more above Nazi earth a big, barrel-chested, brutal-looking fighter plane has an appointment with a Focke-Wulf. This appointment was written down in the engagement book of the Army Air Forces a long time ago, *before we had a fighter plane that could work effectively at 35,000-40,000 feet.*

Keeping this appointment is—the P-47 Thunderbolt!

... escorting heavy bombers on raids deep into Europe ... rolling up combat scores of 2 to 1, 4 to 1, even 15 to 1 against Germany's best fighters.

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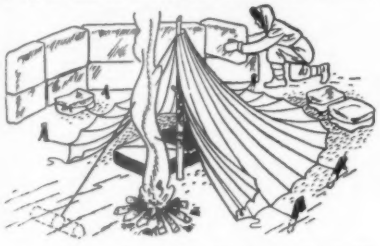
Arctic Emergencies

(*Continued from page 56*)

Don't grow a beard if you can help it—moisture from your breath will freeze on your beard and form an ice-mask that may freeze your face.

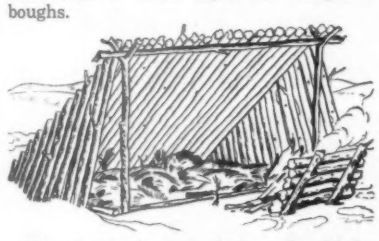
Shelter can be provided in a number of ways. Hard-packed snow drifts can be hollowed out to provide protection for two or three men. If a semi-permanent type of camp is necessary, build an ice house. The ice or snow can be cut into blocks with a machete or a snow knife or with a large blade improvised from a strip of metal salvaged from your plane.



A good tent can be made out of your parachute—with the shrouds serving as stake lines. When you cut your chute free of its harness, save the harness. It can be used as an improvised pack.

Pitch your tent in a sheltered spot but not in the lee of a snow bank where it stands any chance of being buried by drifting snow. If no natural windbreak is available, construct one out of snow or ice blocks. The opening to your tent should be away from the direction of the prevailing wind and the floor should be covered with boughs, canvas wing covers, engine covers or seat cushions.

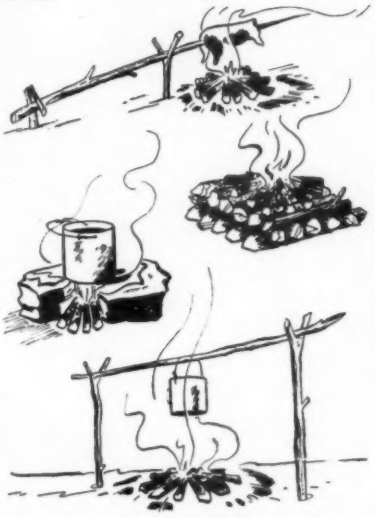
In tree country, a lean-to shelter can be constructed by arranging a framework of poles and covering it on three sides with a thick layer of evergreen boughs.



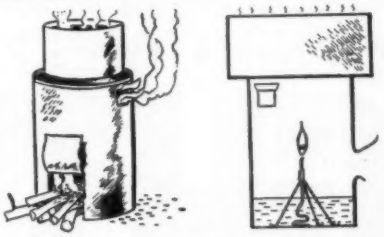
The floor of your shelter should be lined with boughs, canvas, or seat cushions. If you are using a sleeping bag, air and dry it at least once every three days. Wear as few clothes as possible in your sleeping bag. Excessive body moisture will condense and form frost inside the bag. When this happens, turn the bag inside out and beat it with a stick. A damp or frosted sleeping bag is dangerous, keep it dry.

Don't put your sleeping bag directly on the snow or ice. Protect it with a layer or evergreen boughs if they are available or with wing cover, seat cushions, or engine covers.

In tree country, wood for heating and cooking fires is no problem. Various types of fires and fireplaces can be used. Shield your fire from the wind and, in snow country, don't build it directly on the ice or snow. The melting snow will wet the wood and reduce the heat of your fire. Build it on a crib of wood or metal.



If no wood is available, your main source of fuel will be the oil and gasoline drained from your engine. This can be burned in several ways. If the oil is congealed, mold it into small balls. Place one of the pieces in the bottom of an open-top can or any other receptacle that has a draft hole cut near the bottom. Cover it with the kapok or other stuffing salvaged from your seat cushions, pour a very small amount of gasoline over the top and light it. More fuel can be added as desired.



If the oil is liquid, mix a little gasoline with it, pour the mixture into the can over an improvised wick consisting of four or five strands of twisted cord or rag supported on a bent-wire tripod frame, and light the wick. A small flame inside a closed heater of this type will provide enough heat for quick cooking. The same type of tin can heater can be used as an economical burner for small quantities of wood.

A heater for use inside your improvised tent or lean-to need be nothing more than a candle burning inside a small tin can. Or, if you have no candles, a miniature of the cooking burner can be made.

In some Arctic regions surface coal is available as fuel.

Animal fats and hides also provide a source of fuel. A small chunk of caribou suet, for instance, placed on a small piece of wood and lighted, is sufficient to cook enough meat to last three men one day. The hide of a musk ox or a grizzly bear will cook three or four pots of food. Seal blubber also makes an excellent fuel.

Warning: Dangerous carbon monoxide fumes are produced when any kind of fire or heater is burned in an unventilated shelter. Be sure to provide ventilation.

Carbon monoxide poisoning is one of the greatest dangers in the Arctic. Carbon monoxide gas is colorless and odorless. Your only means of combating it is through adequate ventilation, particularly at night. A snow drift may cover your tent and reduce the normal ventilation through the fabric of your tent, so provide some other means of ventilation while your stove or fire is burning. Keep a burner or fire going only long enough to cook your food—then put it out.

Eat as much fat as you can. Fat is a heat-producing food and very important to your health in the Arctic.

In the winter months, animals and fish will be about your only source of natural food. The caribou provides the best meat of the land animals and the seal provides the best of the sea animals.

Polar bear is very likely to be tough and stringy if cooked. It is more tender if eaten raw and frozen. *Avoid polar bear livers, they are poisonous.*

Musk ox meat has a strong flavor but it is rich in fat.

Because of the importance of fats, under no conditions limit yourself to a meat diet of rabbit just because they happen to be plentiful in the region where you are forced down. Rabbits are generally so lean that you have to eat a little too much for comfort in order to get enough energy out of them. Try to supplement your diet with other things.

Some Arctic birds are well supplied with fat—notably ducks, geese and swans. These water birds all go through a two- or three-week flightless period while they are molting in midsummer. The best-known winter birds are the ptarmigan, or snow partridge, which is rarely fat; the white owl, which usually is fat and tasty, and the raven, which is tough. Make a point of finding all the gull and tern colonies you can. Here you will be able to get a good supply of eggs and young birds even without a gun. Such colonies are usually on small islands or cliffs.

On the average, all fish have enough fat to make them good Arctic food. The liver of the cod, for example, is an extremely good form of fat and can be eaten boiled.

Although complete protection from scurvy can be had from a prolonged meat-and-fat diet, the roughage value of greens is important. In an emergency, almost any local green, pleasant to the taste and succulent enough to be swallowed, can be eaten.

There are no poisonous flowering

(*Continued on page 105*)

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(*Continued from page* 101)

plants or grasses in the Arctic. The only poisonous Arctic fungus is easily recognized by its yellowish red cap. All other Arctic fungi found above the northern timberline are edible.

There are no known poisonous plants in the Arctic above the timberline. However, play safe—avoid raw cow parsnip and mosslike lichens; they may make you sick. Berries are plentiful and nutritious. Here are some:

Salmon Berry (bake apple): A low creeping perennial. The edible berries are reddish, turning to yellow as they ripen. They are juicy, about the size of a large raspberry, and ripen in July and August. Common in the north to the Arctic Ocean.

Masu (liquorice-root): A non-climbing perennial herb of the pea family. Grows about one to two feet high. Pink flowers and flat seed pods. The root is edible and when cooked has a taste not unlike carrots. It matures in August and can be gathered until late fall.

Mountain cranberry: A low-creeping shrub with dark green leathery leaves. The dark red edible berries ripen in August and September and remain on the vines through winter. Widely distributed throughout northern Canada and found as far north as the Arctic seacoast.

Blueberry: A low shrub with many branches. The edible berries, resembling commercial blueberries, are deep blue, ripening around July and August. The flowers are greenish white.

Juneberry: A low tree or shrub with bronzy-green foliage. The purplish-black berries ripen in early summer. Found in damp woods and near swamps.

Black crowberry: An evergreen shrub, freely branching. The black, shiny berries are juicy and sweet. Found throughout northern Canada and even on some Arctic islands. Often they can be gathered from under the snow. The berries keep well when frozen.

Wild rhubarb: A perennial herb three to six feet high with reddish stem and pointed leaves. Very common in the Yukon and on the Mackenzie and its tributaries but does not occur farther east. The young, juicy stems are edible and when cooked resemble rhubarb.

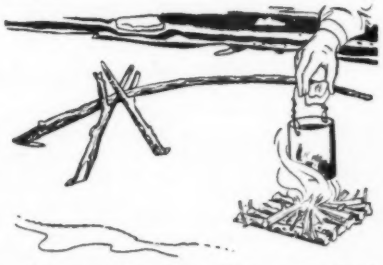
Bistorta: A low-growing herb five to ten inches high. The flowers are white or pink in the form of spikes. The root, about the size of a pecan, is edible and best when cooked. Common in dry country, chiefly north of the tree limit.

In the Arctic, boiling is the easiest and best method of cooking. Boiling not only conserves fuel but preserves the essential elements of the foods. In summer and autumn fresh water will be available except on the ice cap or on the sea. In the winter, ice or snow can be used.

When the boiled meat has been eaten, the liquid remaining should be drunk. Never overcook meat, overcooking destroys the vitamins. For a variation in diet, chunks of meat can be broiled over the fire in any one of a number of ways but the bulk of the fish and meat eaten should be boiled.

At sea, ice that is a year or more old can be used for drinking or cooking water. Old ice can be distinguished from the current year's ice by its rounded corners and by its bluish color in contrast to the milky grayness of salt ice. Ice a year old rarely has any noticeable saltiness, while ice two or three years old is generally fresher than average river or spring water. In the summer, fresh water can be found in the hollows in old ice. Water fresh enough for drinking can be found even in the hollows on new ice, which itself is salty in midsummer.

On land, drinking and cooking water offers no great problem. In the winter it is perfectly safe to eat snow or cracked ice in small quantities during the day when you are traveling and don't want to take the time necessary to melt it down. Eaten in large quantities, however, it chills the stomach and reduces your body temperature.



When melting down snow or ice, don't fill the pot at once. If you do, the snow on top will soak up the first water like a blotter and leave a cavity directly over the heated bottom of the pot and the pot may burn through. This is particularly so when, as the case probably will be, you are using tin cans for cooking containers. When possible, always melt ice for water. It requires less heat and takes less time.

If you were on your flight course when forced down, stay with your plane. Rescue planes will be out looking for you and will find you; but remember—any search takes time. Don't give up hope of rescue too quickly. Travel in the Arctic is difficult. You will need every aid in the way of clothing and equipment that can be made available to you.

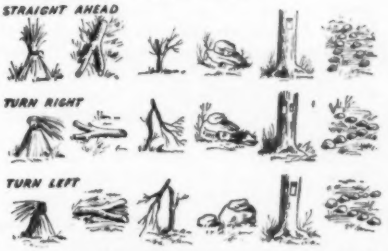
If rescue fails and you decide to walk your way out, lay your plans carefully and then stick to them. What course you decide to follow should be determined largely by your location and the terrain.

In mountainous or wooded areas, your best course, unless you know exactly where you are and have some definite destination, will be to *follow streams and rivers downstream.* They will lead you eventually either to some post of civilization or to the coast where your chances of finding food and a native village will be good. There is just one exception to this rule—in Siberia, rivers and streams should be followed upstream. The rivers in Siberia flow north, while civilization is to the south.

Don't wander aimlessly. Use your compass to maintain a general direction, but don't try to travel in a straight line. Follow the contour of the land for the easiest going in the general direction that you want to go. If you have no pocket compass remove the compass from your plane.

When you camp, camp on the mountains and not in the valleys. Slopes and ridges in the Arctic are always warmer than the valleys.

In thick wood, blaze a trail on the trees as you go, just in case you have to double back on your course.



Plenty of food and rest is the secret of Arctic travel, particularly in the winter. Don't rush, cook at least one hot meal a day and be sure to get adequate sleep. You can survive many days without food if you will relax and avoid exhaustion. Don't worry about freezing to death while you sleep. Unless you are exhausted you will wake up before you freeze.

Before you leave your plane make sure that you are taking everything that will help you make your way back to civilization. Snowshoes, sledges and shelters can be made out of various parts of the plane. Cabin doors, main landing wheel doors and bomb bay doors make good sledges. Skis and snowshoes can be made by removing inspection panels, the cover strips over wing root joints, or tail-wheel doors, and lashing them to your feet with thongs or parachute shrouds. A section of engine cowl can be used as a container for melting water or for cooking, as a head shelter and windbreak for use with a sleeping bag, or as a fire shield for reflecting the heat of your fire into your lean-to or tent.

In the case of a forced landing made with wheels down on an ice floe when no rubber boat is available, an improvised raft can be made by removing the tires from your plane and lashing them together with wire and control cables. The wheels can be removed by stacking ice blocks under the wings so they will support the airplane and permit partial retraction of the landing gear. If there is sufficient time, fuel tanks also can be removed and used as floats. Such improvised rafts will help you to cross open leads and short stretches of sea, *providing the water is calm.*

Before leaving your plane burn all papers, technical orders, and trip data that might be restricted, confidential or secret. Secret instruments should be smashed and the parts buried or thrown into the sea.

Frostbite, or local freezing, is a constant danger to anyone exposed to the sub-zero temperatures of an Arctic winter. Strictly speaking, frostbite cannot be prevented but the risk can be minimized. To neglect a frostbitten spot is to invite gangrene.

There is no particular pain with frost-

bite. Quite the contrary, there is an absence of sensation, a numbness. Frostbite can occur without a person knowing it, so examine your face, hands, and feet frequently. The symptoms are stiffness and a grayish or whitish color of the part affected.

If you are frostbitten *don't apply snow or ice.* Instead, warm the affected part gradually. Don't rub the spot. Even the gentlest massage can do a great deal of harm. If frostbite appears on your face, warm it by grasping it with the other hand. Frozen hands and fingers can be thawed by holding them against your chest or under your armpits inside your clothes.

Frozen feet are particularly serious. Try to keep your feet from freezing but should they get frostbitten, take care of them immediately. Change to a warmer

footgear if you can, or wrap them in cloth or fur until they thaw. Warm them, but don't put them close to a heater or fire. Warm them gradually.

A burning sensation follows the warming and thawing of a frozen part. The actual thawing may be extremely painful. After frostbite there may be blistering and peeling just as in sunburn.

Snowblindness is caused by the brilliant reflection or glare from the surface of snow. Avoid it like the plague, for once you have had one case, recurrences are likely to follow. Wear your goggles, either your flying goggles or your homemade wooden sun shields at all times during the daylight. Don't be fooled by an overcast day and on a brighter day remember that merely lifting your goggles a half dozen times may bring on snowblindness.

The first warning of snowblindness comes when you can no longer detect variations in the levels of ground. Later, your eyes will begin to burn, they will become inflamed and increasingly sensitive. They will pain when exposed even to a weak light.

The best medicine for snowblindness is *complete darkness.* During the long periods of daylight this will mean some sort of dark bandage to exclude all light. An ice compress or cold-water compress will bring some relief providing there is no danger of freezing.

In most cases, snowblindness will disappear in two or three days under care. When first used again the eyes see two of everything but normal focus soon returns.

In general, when an accident happens in the cold, shock is very likely to take place, especially if there is pain or bleeding. An injured person should be covered immediately with blankets, a tarpaulin, extra clothes or a sleeping bag. Keep the head and upper part of the body lower than the legs and lower part. Administer warm, non-alcoholic drinks and apply heat if possible to the chest, stomach, and thighs.

If it is necessary to use a tourniquet don't apply pressure too long at a stretch, as freezing may result. Even tight bandages can dangerously reduce blood circulation. If a tourniquet is necessary, keep the part beyond the tourniquet warm but do not heat it above body temperature.

From the middle of June to about the middle of September when the first of the heavy frosts come, *the worst Arctic pest is the mosquito.* Fortunately, Arctic mosquitoes and flies are not disease carriers but they are extremely bothersome and during the mosquito and fly season head nets, leggings, and gloves will be important parts of your clothing.

Sandflies, found in large numbers on the mainland, are most bothersome in the early afternoon, decreasing their activity as the evening cools. Known as punkies, midges, and "no-see-ums," they are persistent blood-suckers small enough to go through the usual netting or head net.

Bulldogs, sometimes called mooseflies, deerflies, or horseflies, look like overgrown house flies. Their bite is like the cut of a scalpel, drawing blood in a trickle. Bulldogs are most annoying on days. A head net, leggings, and gloves offer the best protection.

Blackflies are bad pests in certain Arctic areas, particularly in the forests during the summer months. Their bite causes severe swelling. Protection against them is the same as for mosquitoes and sandflies. END

Report from Washington

(*Continued from page* 67)

Some congressional leaders who have backed the bill from the beginning are beginning to believe that—as now constituted—it has too many enemies and will not survive. Others, less pessimistic, feel that it will get by the House early in the year, and have enough of its teeth pulled in joint House-Senate committee meetings to draw off some of the opposition and win out.

The only out-and-out optimists on the subject are certain students of it in the Budget Bureau, who predict it will become law before next summer.

As for what the President's attitude is going to be if the bill ever comes up for his signature, he has already gone on record against separating CAA from the Department of Commerce in a little-known letter to Mr. Lea, in which he said in part:

"It would be unwise, at any rate at the present time, to incorporate in the pending legislation a proposal, which I understand has been put forward, to remove the Civil Aeronautics Administration and the Civil Aeronautics Board from the Department of Commerce . . . I fear that the consideration, enactment and putting into operation of such a reorganization plan would so distract the attention of officials and employes of these agencies, and so impair their working efficiency, as to seriously interfere with the contribution that they could otherwise make in the interest of securing successful civil aviation assistance in the conduct of the war."

Flight of Oratory

More gold braid and top names attended the dinner in honor of Orville Wright here December 17 than any other similar Washington gathering since the war began, and the awarding of the Collier Trophy gave point to the oratory.

It took an invitation from no less than the President himself to get Mr. Wright to break his rule against banquets. It is a rule which has seldom been broken, most notably when Wilbur and Orville were banqueted by the Aero Club in Paris, France, September 12, 1908. It had been agreed that neither would have to speak, but the master of ceremonies, as is often the way with M.C.s, double-crossed Wilbur, who rose to his feet and made the following oration:

"I know of only one bird—the parrot—that talks, and it cannot fly very high."

On the eve of the winter aviation dinner speech season, we retell it here for whoever wants to take the hint.

It was a happy affair for Orville Wright in more ways than one, being his first appearance before such a notable gathering since Dr. C. G. Abbott, Secretary of Smithsonian Institution, had issued a statement that, after reviewing all evidence, the Institution had judged itself wrong in designating the Langley plane as the first powered craft to fly.

Dr. Abbott's full retraction culminated his efforts over more than a decade to give the Wright's their just dues.

Looking back across the years, the retraction seems trivial, but in the days when the Wrights had flown, and Langley had not, it was a bitter pill for the Wrights to swallow. The retraction also had pertinence at the banquet, as forecast in the last paragraph of Dr. Abbott's

(*Continued on page* 111)

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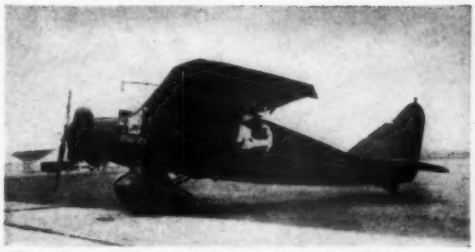

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Caption of news-photo says: "The Cape Cod ... as she was guarded from the curious after the arrival at Istanbul." Russell N. Boardman and John Polando were at the controls.

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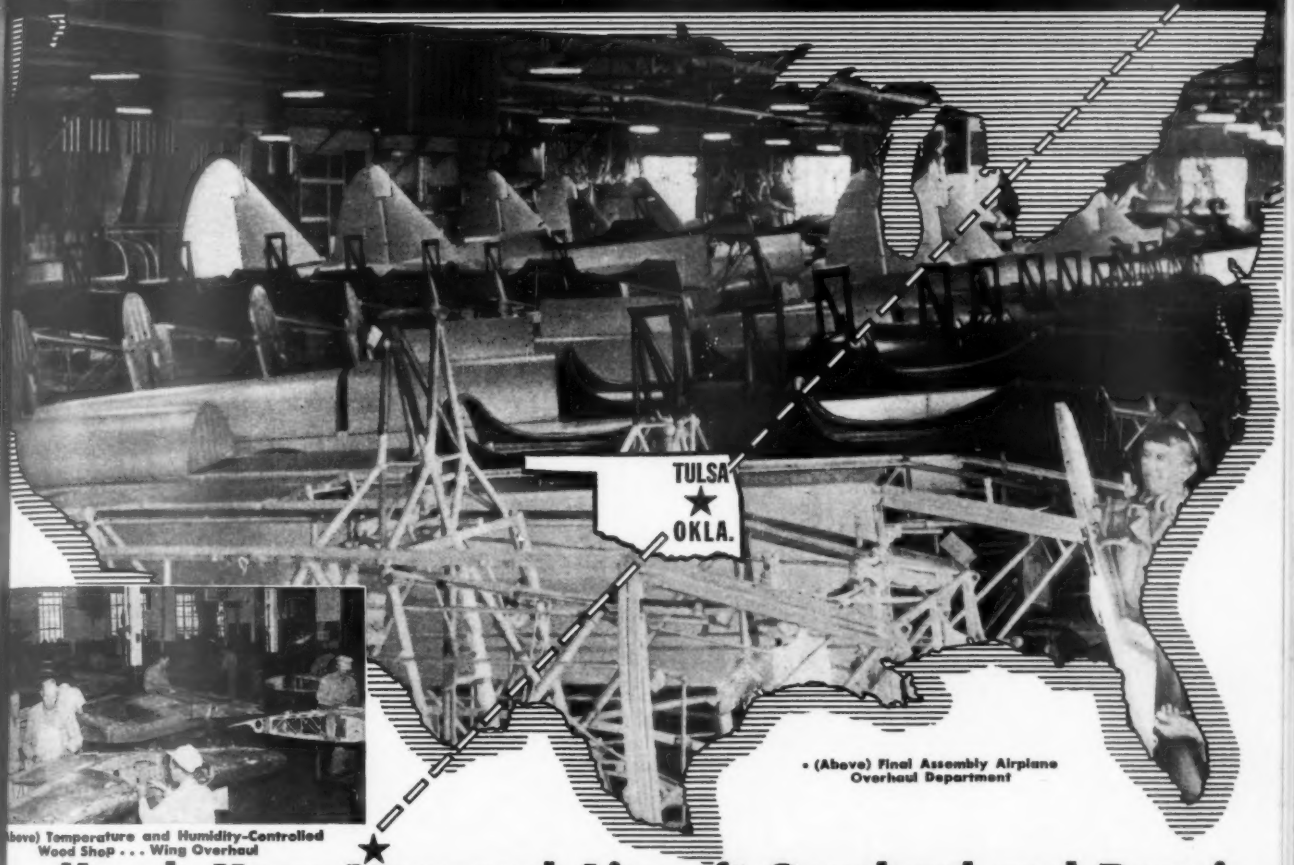

• (Above) Final Assembly Airplane Overhaul Department

(Above) Temperature and Humidity-Controlled Wood Shop . . . Wing Overhaul

Here's Your Approved Aircraft Overhaul and Repair

(Above) Landing Gear Overhaul and Assembly

• (Above) Spray-Painting Airplane Control Surfaces

Here in the heart of the nation is the expert, trustworthy overhaul and repair service on which private aircraft owners can depend . . . *now and in the peace-time future ahead.* SPARTAN AERO REPAIR is 100% Government Approved—one of the highest rated in the nation—with the most extensive and modern facilities in this part of the country!

The Airplane Overhaul Department pictured here is equipped for the repair and overhaul of everything on the private airplane whether it be of wood, fabric or metal construction. You'll find a corps of expert workers in all of its various service departments: the final assembly department—the air conditioned and humidified wing overhaul woodshop and wood storage—the landing gear department—the dope shops, etc.

SPARTAN AERO REPAIR also provides expert service for all component parts of planes—superior engine test stands—latest test equipment for engines and accessories—entirely complete instrument shop and radio shop.

Important war-time contract service to the U. S. Army Air Forces rates first consideration at Spartan Aero Repair, yet every effort is made to also assure private owners the efficient and skilled service they desire.

Depend on Spartan to serve you!

SPARTAN AERO REPAIR

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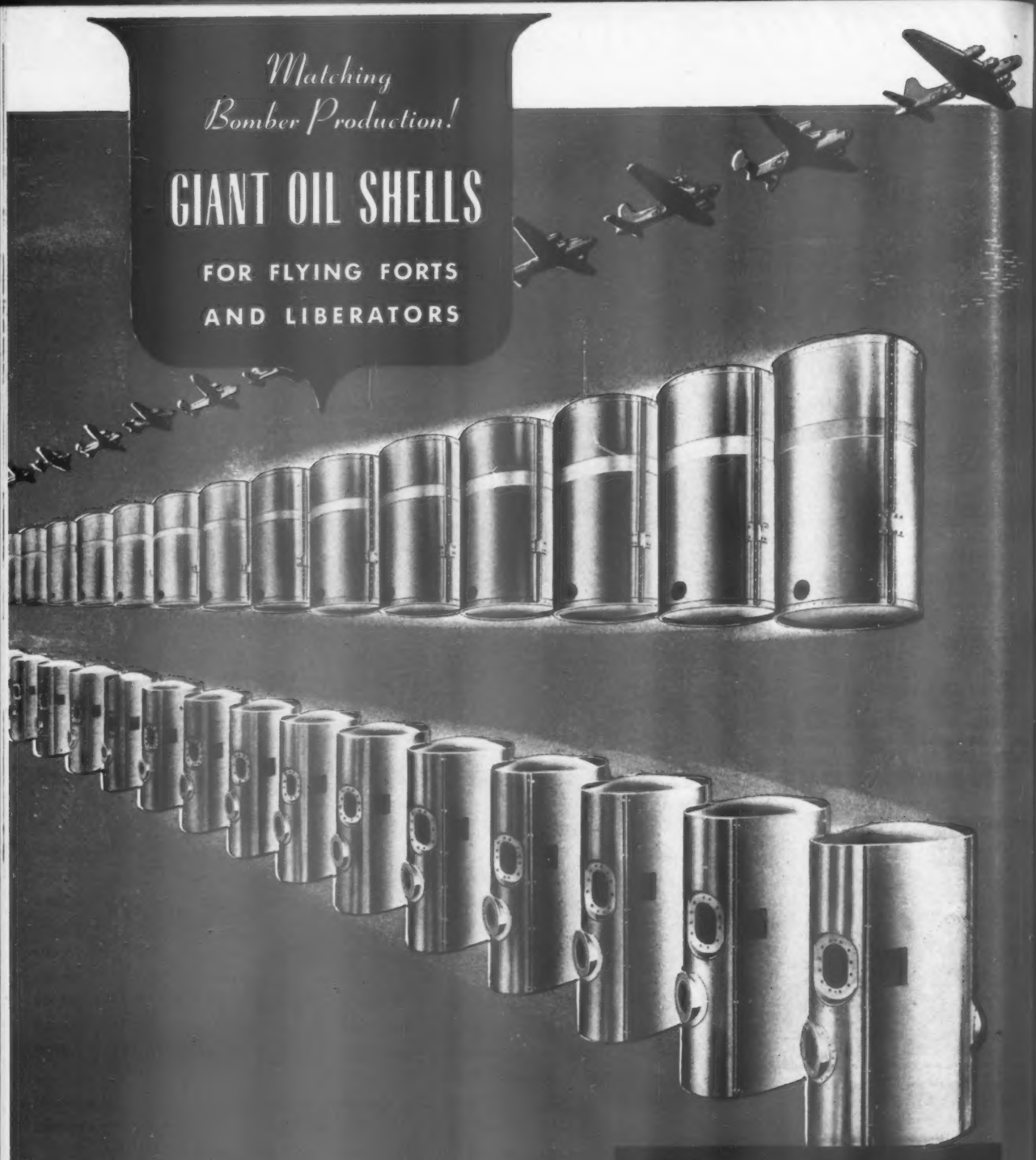
TULSA, OKLA. Established 1928

Matching Bomber Production!

GIANT OIL SHELLS

FOR FLYING FORTS AND LIBERATORS



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POULSEN & NARDON, INC.

LOS ANGELES 11, CALIFORNIA

(*Continued from page* 106)

statement:

"If the publication of this paper should clear the way for Dr. Wright to bring back to America the Kitty Hawk machine (from England)—to the United States National Museum, it would be given the highest place of honor, which is its due."

Thus, while crediting the Wrights with making history, did Dr. Abbott write a chapter of his own which will prove another landmark, not only in amity between the world's first aviators and Smithsonian, but between England and the United States.

* * *

P-38's

If any one still believes there is unfriendly rivalry between *Fortress* crews and fighter pilots, let them heed the melodic words of T/S Robert H. Bryson, radio operator-gunner, written after an unescorted mission in a *Fortress* in North Africa:

O, Hedy Lamarr is a beautiful gal
And Madelaine Carroll is, too!
But you'll find, if you query, a different theory
Amongst any bomber crew.
For the loveliest thing of which one could sing
(This side of the heavenly gates)
Is no blonde or brunette of the Hollywood set—
But an escort of P-38's.

This is equalled in enthusiasm only by the statement of America's second ranking Marine ace, Lieut. Kenneth A. Walsh, of Washington, who told newspapermen here recently that for his money air fighting was "the greatest sport in the world."

* * *

Tomorrow's Transports

The persons who know the most and are doing something about tomorrow's transports are, significantly, not talking. Their silence is all the noisier when you listen to the booming voices of the prophets who envision an airport in every backyard and helicopters, two to the garage.

Most silent of those in the know are members of the Air Transport Association's Aircraft Requirements Committee. Their names bear repeating for the record, for all of them are experts in the transport field. The membership includes William Littlewood, vice president in charge of engineering for American Airlines; B. J. Vierling, superintendent of maintenance for Pennsylvania-Central Airlines; Charles Froesch, chief engineer for Eastern Air Lines; W. C. Mentzer, chief engineer for United Air Lines; K. O. Larson, chief engineer for Northwest Airlines; Stanley R. Shatto, vice president in charge of engineering and maintenance for Continental Air Lines; A. A. Priester, vice president and chief engineer for Pan American Airways, and J. C. Franklin, vice president in charge of engineering for Transcontinental & Western Air.

The reason these men are not talking about post-war transports is because they say they don't know the answers yet—another paradox in a world of experts. It becomes even more paradoxical when you add that the ATA committee already has on hand plans for post-war models submitted (at the Committee's request) by such transport-building leaders as Boeing, Douglas, Lockheed, Consolidated, Curtiss-Wright, Martin and Fairchild, among others.

ATA's request was for two twin-engined models and two four-engined jobs, all-purpose transports capable of handling traffic routes varying from 30 miles with seven passengers to trans ocean hops with 50 or 60 passengers.

Plans submitted are said to envision some planes large enough to seat 100 passengers, with luxurious quarters including promenade decks and cocktail bars.

Aircraft designers also were asked to submit ideas for revamping transports and other equipment now flying in the war so that they can be used to fill the gap between the declaration of peace and the day when new models are ready to go into service. Special emphasis was placed by ATA upon the necessity for high-efficiency hydraulic brakes, thermal de-icing (they expect this one to be practicable in a matter of weeks for all transport equipment), fire prevention, and tricycle landing gear or its equivalent in low-to-the-ground doors to overcome present freight loading problems on such models as the Douglas transports. One tentative admission has been made to us about what planes will be immediate post-war favorites, according to a number of ATA committee members. These are DC-3's and CW-20's.

Chief reason for the notable silence of the committee members is that they had no intentions in the beginning to publicize the plans first submitted by aircraft designers. Details are all too tentative. The idea now is to go over the plans, study them carefully, revise, and then—probably early in the spring—submit to the designers counter-proposals and changes for models they believe will meet the exacting needs of post-war air transport operators.

What does the Committee think of the plans already submitted? No comment. Could we see some of them? No? Could we peek? We-e-ll—we got a couple of peeks. We remarked after glimpsing some over-all sketches and a couple of floor plans that the models under inspection looked pretty much like the models you see on any big airport's apron today—only bigger and better. That's right, we were told—no radical design changes had shown up so far and none was expected. For the information of the prophets, ATA and the transport industry both are of the opinion that radical flying-wing designs you see in the feature sections are a long, long way off.

* * *

Briefings

The Harvard School of Business is

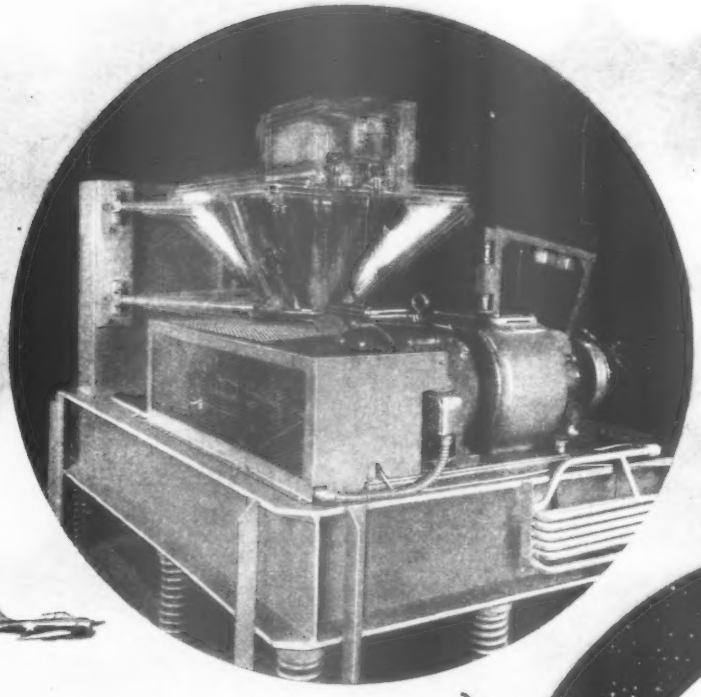
(*Continued on page* 114)

"Gee whiz, Sultan, it sure is good to see you again."

BUY WAR BONDS

RCA AVIATION RADIO

Efficiency and stamina proved by severe and exhaustive tests at every step of design and production

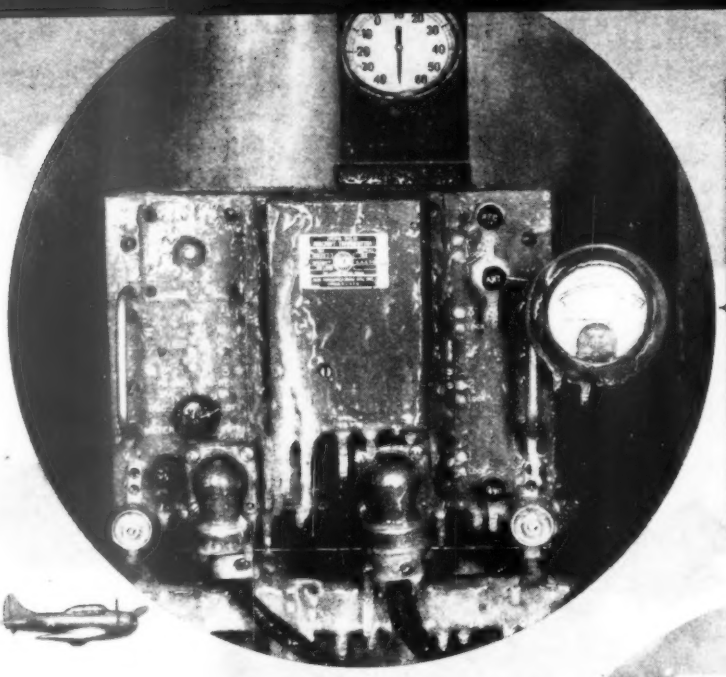


SHAKE-DOWN TEST

Just as a naval vessel undergoes a shake-down cruise, RCA AVIATION RADIO equipment gets its "shake-down" cruise, right in the RCA laboratory. On the machine shown above, it is subjected to vibration up to 3,000 cycles a second. Vibration duplicating that of the smallest plane to the largest bomber—accelerations equivalent to ten gravities!

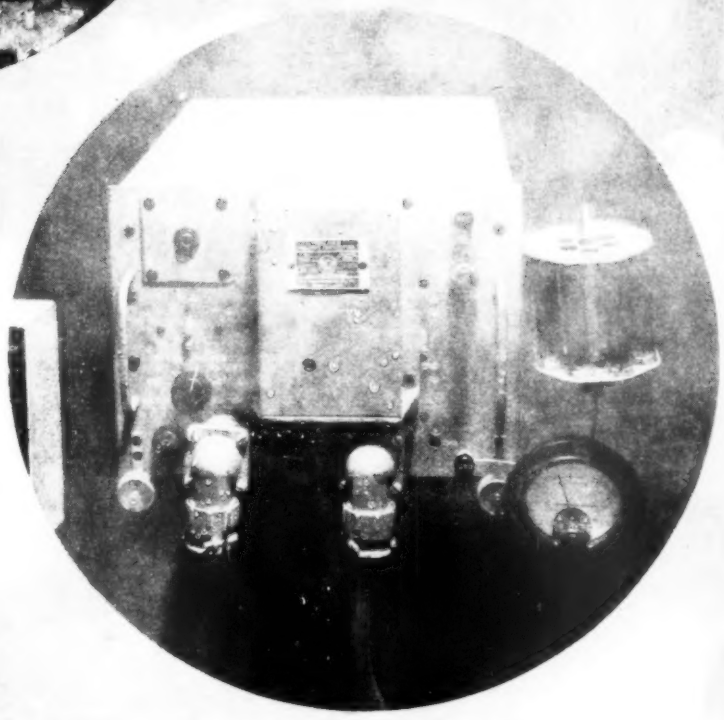
ALTITUDE: 40,000 FEET

In this RCA plastic "altitude" chamber RCA AVIATION RADIO equipment is tested at low atmospheric pressures—checked for high altitude flashovers and leaks—scanned for tuning shifts and "breathing"—inspected for evidence of every kind having any possible bearing on its ability to give dependable service at any altitude.



ARCTIC REHEARSAL

It's cold at high altitudes—but aircraft radio must function despite frigid temperatures. That is why RCA AVIATION RADIO equipment is subjected to intense cold in RCA laboratory refrigeration chambers—cold well below the lowest stratospheric temperatures—as low as —76°F.



"SWEAT ROOM"

In steaming jungle landing-fields and dispersal areas RCA AVIATION RADIO equipment must serve without failure or faltering—regardless of heat and humidity. The ability of RCA aircraft radio units to meet extreme requirements is assured by exposure to steam-saturated atmospheres at 140°F. and 95% humidity!

RCA

RCA AVIATION RADIO

RADIO CORPORATION OF AMERICA

CAMDEN, NEW JERSEY

(*Continued from page* 111)

planning a study of what to do with surplus combat and other military planes post-war. The AAF is said to be more than casually interested in the project. . . . One of the most puzzling violations that recently has come before the CAB concerned eight WTS instructors at Mt. Pleasant, Mich., who, when their co-ordinator refused to let them have a beer party, took a student each and a plane each and put on an aerial rodeo over the town. Seven had their ratings revoked and their licenses lifted for 90 days, one got his certificate suspended. Puzzling thing about the incident was the ring leader — Ford Trucks. Investigators thought it was a gag or even a conspiracy by a rival form of transportation till they checked the records. Sure enough—it's a name. . . . Patricia O'Malley, manager of the public information department of TWA in Washington, recently told co-eds at the University of Wisconsin that "you can meet more interesting men in aviation than in any field in the world." . . . The national research center for pilot training at the University of Tennessee, sponsored by the CAA, is expected to attract some of the best research talent in the nation when it gets going. . . . A. L. Morse, chief of the aircraft development section, technical development division, CAA, reports that the bird-resistant windshield experiments he and his associates made headlines with last summer were so successful that United is planning to install them in all its DC-3's and Douglas is adapting one for all new models. . . . Among other things, the section is now working on three kinds of simple and inexpensive stall-warning indicators, two for private flyers and one for transports. Stall-warnings are to be a combination horn and light so that the pilot's ears as well as his eyes will be informed. . . . Don't look now, but that airline DC-3 overhead probably was recently returned to its private operator by the Army, which already has returned some 20 DC's and several Lockheed *Lodestars* to the operators. Eastern got the first DC-3 early in December. . . . The reason why leaves vary for pilots on different combat fronts is largely because of the distances involved. Tight combat conditions also contribute, as well as varying fatigue factors. Generally, a pilot gets home after 100 missions in the Pacific, after 50 in the Mediterranean, after 25 in Europe. The German front in northern Europe is considered the toughest—a sentiment to which Nazi subscribes. END

CAB Grab-Bag

(*Continued from page* 47)

work on such legitimate applications in a number of ways. Applications are grouped according to economic regions and according to the services applied for. A weekly summary of applications in these areas is sent to all interested parties. Examiners also study applications by areas, handling a large number at once, rather than one at a time, as was formerly the case. Trial examiners have been organized in an office completely separated from other Board activities and accountable only to Board members. Board members hung up a new record recently by handing down a decision within 24 hours after all the evidence was submitted.

On the pessimistic side, there are at the present time only 15 trial examiners working on the Board, and some of these may soon be lost to the draft or better jobs. This is serious so far as applications are concerned, since the entire processing of them is built around the examiner's work. You file an application for an airline franchise (with 20 copies) in the Board docket room. Your application is grouped with others like it by an examiner. He then invites your lawyer to meet with the lawyers of rival applicants for a pre-hearing conference. Agreement is reached on what evidence shall be introduced and the applicants decide on the date they want to hold the hearing. On the basis of the evidence, the examiner makes a report to the Board members recommending how the service certificate shall be awarded —it is he, in sum, who keeps the applications moving and brings them up to the point where action is taken.

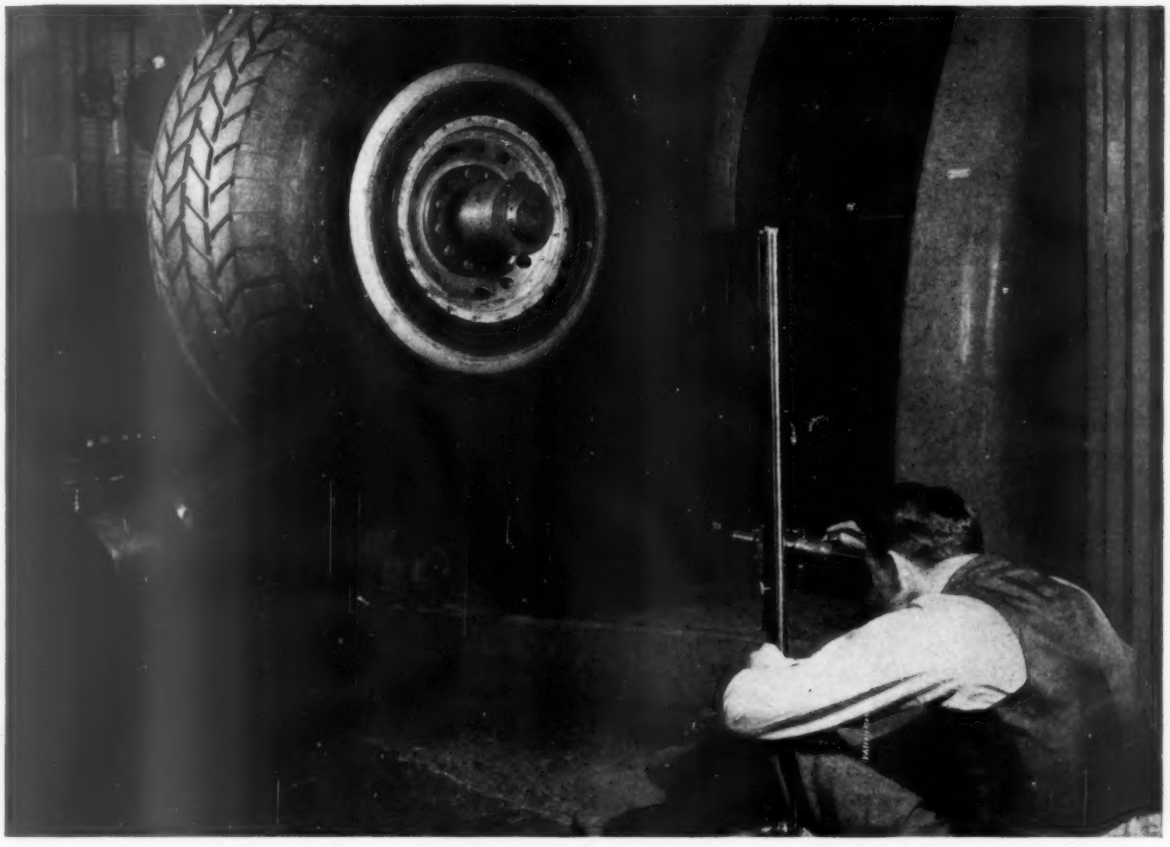
Even without present diversions, this is a long and ponderous legal process. That it is too long and too ponderous and overlarded with bureaucracy, Board spokesmen deny. They point out that the Board is a young agency and that lawyers say its procedures shine in contrast to older quasi-legal Washington bodies.

On the other hand, it is fair to raise the question whether they are fast enough to keep up with a young and lightning-fast industry. Many airline executives contend that at times the Board is slower than molasses, and that even after an examiner has submitted clear-cut recommendations, Board members take an inordinately long time acting. A recent delay—which the Board, incidentally, blames on the Army—ran to more than four months. The Board's reply is that it is acutely conscious of the problem, is doing everything possible to solve it, and—at the same time—continues to be understaffed and overworked.

One of the most important problems CAB has to cope with in the domestic postwar picture is the extension of feeder services and pick-up stations. Greyhound Buslines have already applied for a helicopter service permit covering 53,000 miles throughout all sections of the United States. Not only have they filed with CAB for the certificate, they have gone a step farther with elaborate models, streamlined blue and gray jobs. Greyhound's proposed 14-place helicopters would not compete with present established air carriers, it is contended, but would be used as an intermediate link in a bus-to-helicopter-to-main-airline set

(*Continued on page* 120)

"Hey! Can't you remember? We were transferred!"



HE'S FINDING OUT HOW TIRES GROW ...TO IMPROVE AIRPLANE DESIGN

It has long been known that tires tend to grow in radius as a result of centrifugal force, affecting the amount of clearance needed between a tire and its landing gear strut. But how much do they grow? This fact is important to designers of today's faster-landing aircraft.

B. F. Goodrich engineers set out to actually measure tire growth. They used a tire-testing machine which accurately simulates take-offs at speeds up to 140 mph. A telescopic sight with a hairline rule was focused at a fixed point on the tire's circumference, and the take-off speed was varied from 140 mph down to 0 mph. Several sizes of tires were tested and carefully measured at these speeds.

Our engineers discovered that tire growth varied only with the speed, and very little with the size of the tire tested.

In other words, at the same speed, a 30" and a 56" smooth contour tire grow about the same amount.

Facts gained this way are of material help in designing landing gear and tires that will afford maximum safety for modern aircraft.

Today, all our research and production facilities are geared to total war. Tomorrow, the "know how" we're gaining now will help bring you a world of safer flight. The B. F. Goodrich Co., Aeronautical Division, Akron, O.

Skyway or Highway

B.F.Goodrich

FIRST IN RUBBER

Awards to 8 plants

MAKERS OF MORE THAN 80 RUBBER AND SYNTHETIC RUBBER AVIATION PRODUCTS

Keeping 'em Flying

WITH CHAMPION SPARK PLUGS

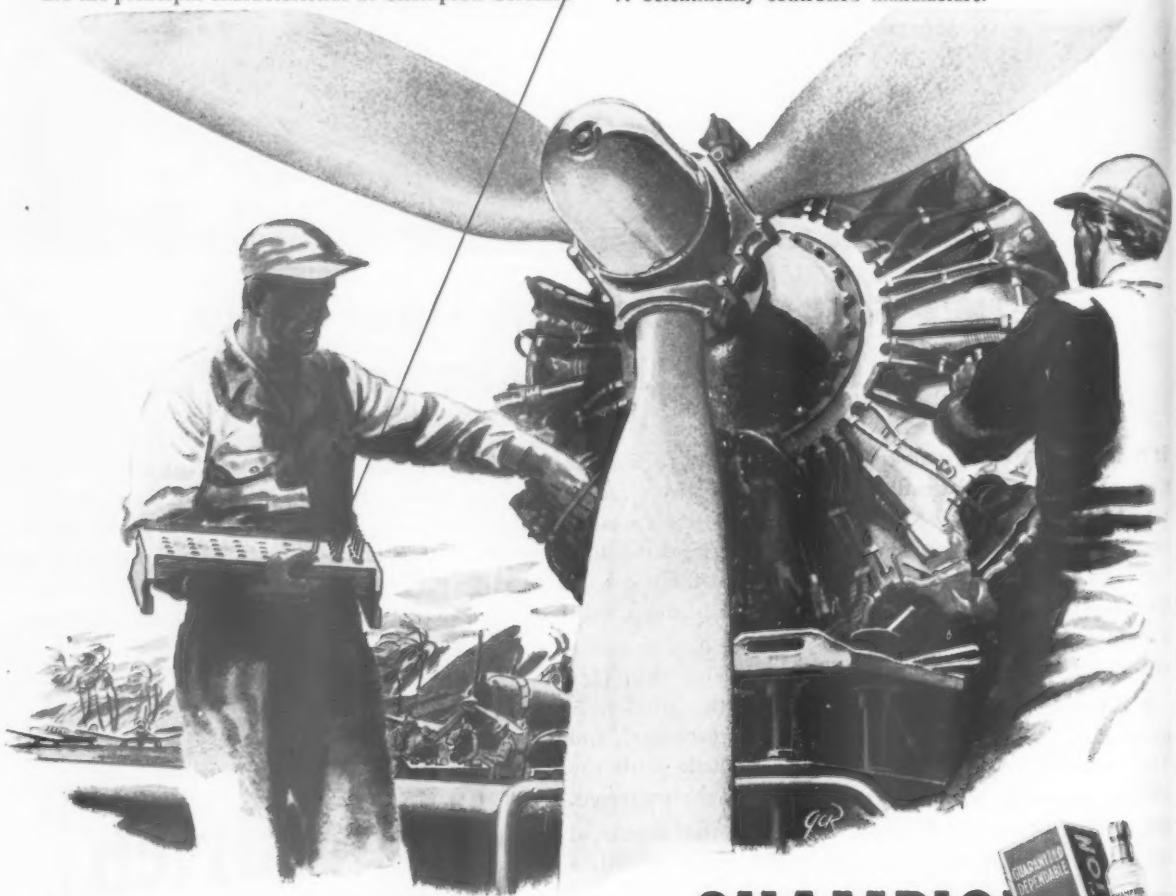
The men who literally "keep 'em flying," the ground crew mechanics of the Army, Navy, Marine and Coast Guard Air Forces, are daily performing prodigies of maintenance, service and repairs.

These unsung heroes, schooled and skilled in many crafts, keep their charges airworthy and in fighting trim at all times. The stories, already legion, of the fantastic things they have performed under emergency conditions on every battle front are a tribute to the inherent ingenuity of the American mechanic.

One of the first things the ground crew mechanics check is spark plugs, because they know how vital they are to the engine's performance and dependability. Outstanding performance and dependability are the principal characteristics of Champion Ceramic Aircraft Spark Plugs—qualities which have won for them an ever increasing demand from our Air Forces.

Characteristic advantages of Champion Ceramic Insulation are:

1. Immunity from heat and chemical reactions.
2. Freedom from fuel, oil, or moisture absorption which causes "shorts."
3. Inherently high heat conductivity with consequent wider range between pre-ignition and fouling.
4. Absolute uniformity of material.
5. Homogeneous structure eliminates air spaces which cause current leakage.
6. Easily cleaned and serviced—no specialized equipment or factory returns necessary.
7. Scientifically controlled manufacture.



ARMY (E) NAVY

"...Let Freedom Ring" BUY WAR BONDS

CHAMPION SPARK PLUGS

Background for Leadership

Fleetwings believes that the soundest kind of post-war planning is more production *now*. The mass-assembly of surface parts for America's great fighting and bombing planes is the best contribution Fleetwings can make toward the better world we are fighting for. For years, Fleetwings has pioneered in the designing and production of planes, plane parts and hydraulic equipment. Its role in the early history of aviation guarantees the importance of the name Fleetwings in the air developments tomorrow. In the post-war world, there will be no substitute for this experience. It is something aviation will always need.

ARMY E NAVY

Plant No. 1

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Division of Kellett Corp., Inc.

BRISTOL • PENNSYLVANIA

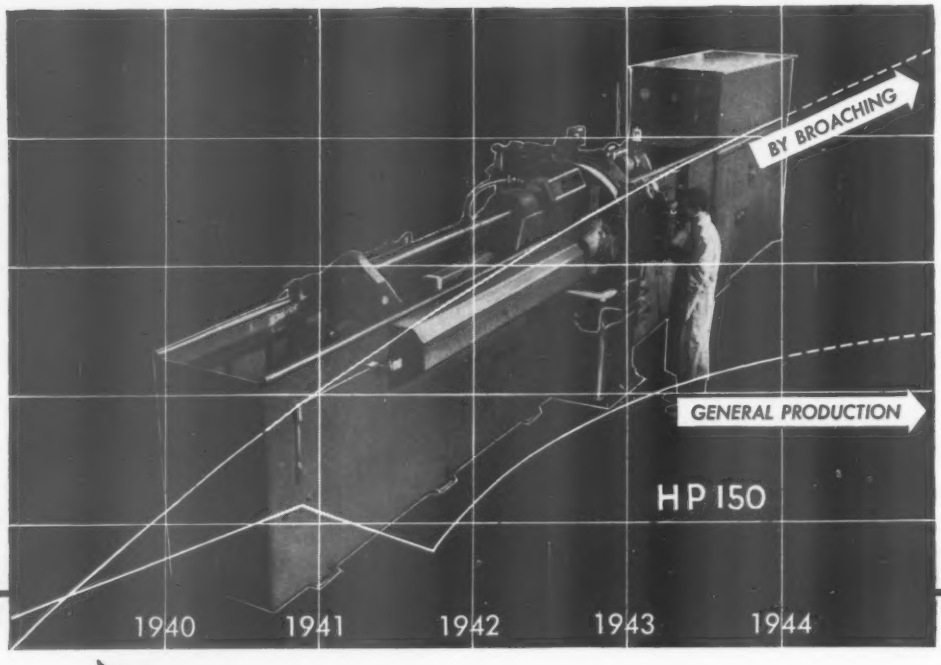
PROTECTION...

of Vital Production

of Vital Manpower

of Vital Time

BROACHING PRODUCTION FIGURES BASED ON ACTUAL SURVEY—

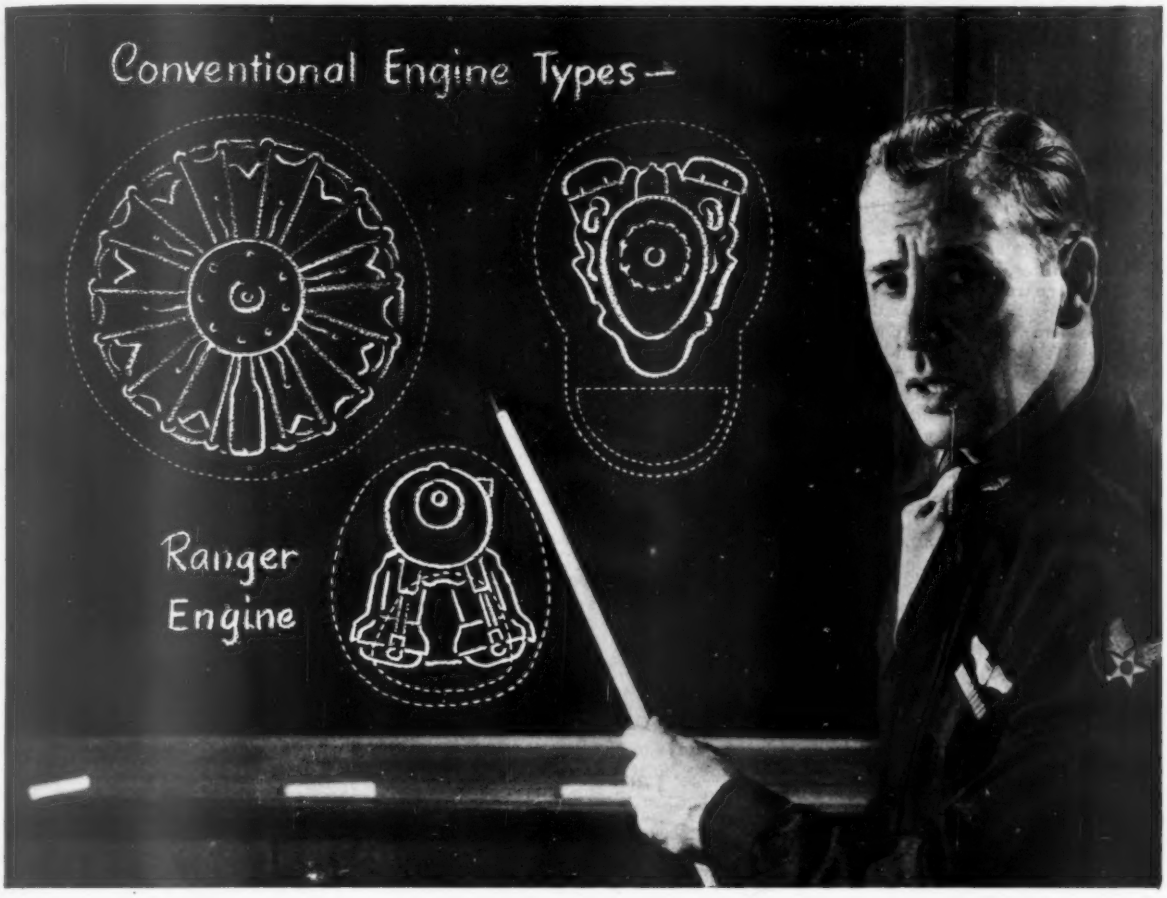


ARMY E NAVY

The LAPOINTE Machine Tool Company

HUDSON, MASSACHUSETTS, U. S. A

POINTERS ON ENGINES . . . . . *No. 1 of a Series*



Why Ranger Turns The Power Plant *Upside Down*

The Ranger Aircraft Engine is unique.

It is the *only inverted*, in-line, air-cooled engine in production today.

Fairchild engineers worked ten years developing and perfecting this outstanding inverted power plant. They sought a practical engine design that would:

1. Make flying safer by giving the pilot greater vision than is possible with conventional engines.
2. Increase efficiency of performance by reducing and streamlining the air-resisting frontal area.
3. Simplify the usually complex task of maintenance and daily inspection (a vital safety factor) through easier access to the power plant of the airplane.

That the Ranger Engine fills the bill on these 3 vital counts . . . and on others, too . . . is attested by the fact that the U. S. Army Air Forces have chosen Ranger-powered planes, the famous Fairchild PT-19's and AT-21's, for the task of training quickly thousands of pilots and aerial gunners.

When Fairchild engineers turned aircraft engines upside down and produced the Ranger, they did it with an eye to safer, speedier, more efficient sky travel—another example of Fairchild's "touch of tomorrow in the planes of today."

BUY U. S. WAR BONDS AND STAMPS

RANGER AIRCRAFT ENGINES

Division of Fairchild Engine and Airplane Corporation · Farmingdale, Long Island

(*Continued from page* 114)

up. Greyhound is putting in a lot of time on this ambitious scheme, realizing that bus terminals provide ready-made landing fields for this fast helicopter service to main air routes.

Another angle of domestic flying which has attracted many aspirants is typified by the application filed by Parks Air College in East St. Louis. Here the idea is to extend feeder service throughout the Mississippi Valley to the main air lines. Sectional feeder service applications have come in from all parts of the country and range from small hops to networks covering entire sectional areas.

Among the railways filing with CAB for feeder service permits are the Kansas City Southern, Missouri-Pacific and Burlington. Trucking companies are also trying to get in on the ground floor of the feeder service boom. Heading the group of big trucking outfits is Keeshin, with an application asking for 60,000 miles of air freight rights.

Steamship companies have been on the alert to put in their bid for subsidiary air service. The list, which includes United Fruit, reads like a pre-war Cook's Tour folder.

The "big league" airlines are all asking for their own feeder services adjacent to their main trunk lines, and are holding out for their hard won independence from monopolies and surface transportation systems.

Another phase of domestic aviation which is looming large on the CAB horizon is air pick-up service. Application has been filed by All-American to extend its service to 237 communities in the states in which it now operates, taking in additionally New Jersey, Connecticut, Rhode Island and Massachusetts. Present air pick-up routes flown by All-American include 117 cities in West Virginia, Pennsylvania, Ohio, Kentucky, New York and Delaware. Nine independent companies have applied for authorization to establish air pick-up routes in 26 other states which would service about 1,375 communities now without air service and add 25,000 miles to the air transportation system.

The plans of big airlines stretch far beyond the domestic boundaries. Globe-girdling routes charted on post-war maps tie the world together in a neat summary of hours and minutes, and applications for certificates to fly these international airways are piling up on the desks of CAB like a snowstorm. An agreement staking out in general terms the spheres of influence to be observed by U.S. airlines in the international agreement was signed by all the major companies except two, United Air Lines and Pan American Airways. They also are the only two of the major companies who have not filed for CAB certificates giving authorization to fly the international airways as outlined in the agreement formulated by other U.S. lines.

In general, the big airlines have divided their post-war global ambitions as follows: Northwest Airlines: Seattle to Calcutta over the Alaskan route via Manila, Tokyo, Peiping and Shanghai; Chicago and Southern: Chicago to Java via Shanghai, Canton, French Indo-China and Singapore; Northeast Airlines: Boston to Moscow via the Azores, London, Paris, Holland, Denmark and Sweden; TWA: to London, Paris and Cairo via the Azores; American Airlines: to London and Paris. American Airlines now holds a certificate for an air route to Mexico.

The only present holders of international flying certificates (aside from American's to Mexico) are American Export to Portugal, and Pan American, which has an imposing list including South America, Central America, the Canal Zone, Caribbean area, Leopoldsville in Africa, and neutral Lisbon.

CAB recently sent a memorandum around to all holders of and applicants for certificates for international air routes explaining in full detail the statement issued to the press by the State Department and the Civil Aeronautics Board on October 14, 1943, which indicated the general procedure to be followed in dealing with applications for the foreign routes. The press release stated that future landing rights abroad, negotiated by the Department of State after consultation with the Civil Aeronautics Board, would be acquired in general terms. The assignment of such rights to any carrier or carriers would be determined by the Civil Aeronautics Board.

Apparently both the State Department and the Civil Aeronautics Board were pelted with questions as to whether it would be consistent with this policy for the individual companies to make direct approaches to a foreign government or foreign air carrier with the idea of obtaining landing rights or making operational arrangements. The answer to that one was that while acquisition of landing rights by inter-governmental negotiation is expected to be the general procedure, the practice is not arbitrary or inflexible, and any carrier may present unusual or compelling reasons it feels would justify independent negotiations abroad.

However, Civil Aeronautics Board and the State Department toss back three underlying reasons to restrain ambitious carriers from direct negotiations with foreign governments or air companies: *first*, to avoid the confusion and embarrassment resulting from several American lines competing with each other in negotiations with foreign governments and carriers; *second*, to avoid the possibility of a certificate turn-down by CAB *after* the applicant had successfully completed foreign negotiations; *third*,—and this one carries a punch line—to avoid any exclusive arrangements being negotiated by an individual carrier which would be designed to restrict the power of carrier selection by the CAB, which stresses: "In the interest of equity to all U.S. air carriers, the Board could not be influenced in the final selection of a carrier by consideration of special or private arrangements previously concluded by that carrier on its own initiative."

In handing down decisions, it is understood that the Board follows certain definite policies:

Amateurs in aviation—young or old—need not apply.

Railroads and other modes of transportation will not be permitted to "muscle in" on the control of air carriers.

Similarly, steamship lines will be denied control.

There will be no monopoly of U.S. foreign air transport by one U.S. line. Everyone will be given equal consideration according to his capabilities.

Local airlines—pick-up services in limited areas, helicopter bus services and feeder services—will be encouraged in post-war activities to team up with long-distance express airlines rather than bus or railroad lines.

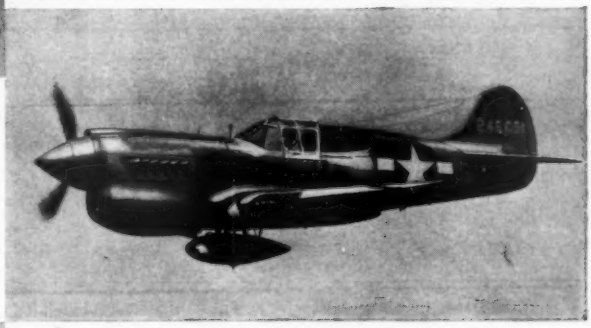
If it looks like a hard-working future and plenty of headaches for the Board, the facts also seem to point toward a harder one, so far as air transport is concerned, for the railroads, steamship interests, the ambitions of Pan American, United's foreign policy, fly-by-night promoters, and air transport talent at Woodrow Wilson High.

When the Greyhound company filed applications for 53,000 miles of routes, they exhibited this model of a 14-passenger helicopter air bus as proposed vehicle.

How LIGHTER Airplane Tires Carry HEAVIER Loads

How "U.S." Tire Engineers Answered the Need for Tires That Can Take the Increased War Load—without Increasing Tire Size

B-17 Boeing Flying Fortress—The gross weight of the Fortress was 45,470 pounds in 1940. Today, with thirteen heavy guns, with bullet-sealing fuel cells carrying a long-range gas supply, with 10 tons of bomb load, the B-17 weighs approximately 65,000 pounds. But even with this added load, landing at higher speeds, the original 19.00 x 23 tire size was increased only slightly. "U.S." tire engineers first built rayon cord tires as gross weight increased. Then came U.S. Royals with Nylon bodies delivering 64% more strength than rayon tires.



P-40 Curtiss Warhawk—Armed at first with but two machine guns firing through the propeller, today's P-40 carries six heavy guns, a thousand-pound bomb load, and much greater armor. Bullet-sealing fuel cells, heavier, more powerful engines and superchargers, along with other new equipment, raised the 1940 weight of 6789 pounds to 9000 pounds today. Again, lighter U. S. Royal Rayon Cord tires carry this increased load at higher landing speeds without even a fraction of an inch being added to the tire size.

B-24 Consolidated Liberator—In 1940, the B-24 weighed 41,000 pounds. Today, it weighs 65,000 pounds, increased over 50%. From six machine guns to over a dozen in four power turrets, with bullet-sealing fuel cells, with increased armor protection and ten tons of bombs, the original tire size still had to do the job. Lighter, U. S. Royal Rayon Cords replaced heavier, bulkier cotton. And today, more "muscle" to carry the thirty-ton load is built into the new Nylon tires supplied by "U.S." to the Army Air Forces.

P-39 Bell Airacobra—When first produced, the Airacobra weighed about 6000 pounds. Today with heavy machine guns replacing light, with bullet-sealing fuel cells instead of aluminum tanks and greatly increased armor, this fighter weighs 7404 pounds. Tires with cotton cord bodies would not do the job. "U.S." tire engineers, who pioneered rayon cord tires for airplanes, decreased tire weight, added the strength to carry a third more weight—without adding a fraction of an inch to the tire size!

U.S. Royal Airplane Tires and Tubes are engineered for today's loads. They are available in all standard sizes for nose wheels, landing wheels and tail wheels in Static Conductor Construction. Your nearest "U.S." Field Airplane Tire Engineer will work gladly with you on any tire or tube problem.

1230 Sixth Avenue - Rockefeller Center
New York 20, New York

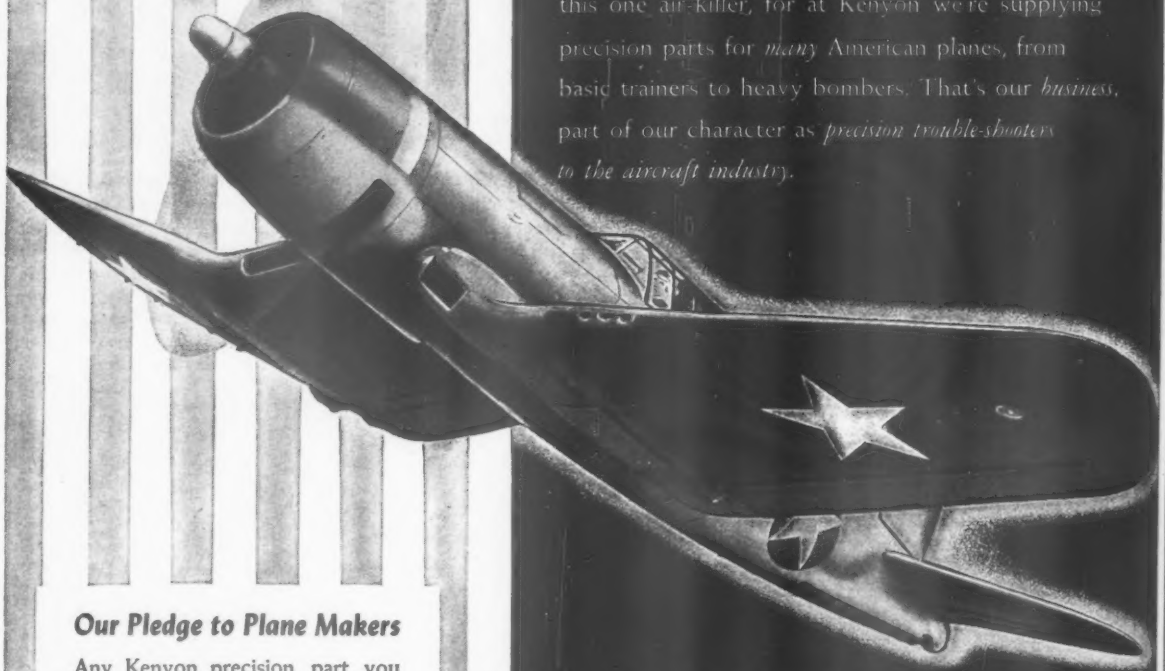
UNITED STATES RUBBER COMPANY

GULL-WINGED JAP KILLER

F4U-2 to the Navy, she's the "Corsair" to Vought, her maker, and the Navy pilots who fly her bad news to the enemy who must fight her.

We're proud of the "Corsair" at Kenyon Instrument Co., happy to be able to supply some of the precision parts that help make her what she is —fast, tough and "sweet to fly".

And our pride is based on more than the fact that we have some small hand in the production of this one air-killer, for at Kenyon we're supplying precision parts for *many* American planes, from basic trainers to heavy bombers. That's our *business*, part of our character as *precision trouble-shooters to the aircraft industry*.



Our Pledge to Plane Makers

Any Kenyon precision part you want, you'll get—*on time. Whatever* precision part or instrument you need, Kenyon will *make* for you—even if it has never been made before.

For Precision and Pioneering
THINK OF KENYON

KENYON
INSTRUMENT CO., INC.
HUNTINGTON, L. I. NEW YORK

If It's Kenyon-Made KENYON *It's Precision-Built*

Official U. S. Army Air Forces photograph of the second Schweinfurt raid. Dotted rules and letters indicate heavily bombed target areas.

Schweinfurt Story

Both sides knew it was a major engagement — that second bombing mission against Schweinfurt. It was a battle between large armies, for a crucial objective. The Nazis massed 60% of their total fighter strength in a vain effort to prevent the Boeing Flying Fortresses from getting through.

In a period of a few hours the Forts invaded German-held Europe to a depth of 500 miles, sacked and crippled one of her most vital industries. They did it in daylight and they did it with precision.

They moved in on a city of 50,000 people and destroyed the part of it that contributed to the enemy's ability to wage war. When that part of it was a heap of twisted girders and pulverized machinery, they handed it back, completely useless, to the Germans.

• • •

This is the task for which the Boeing Flying Fortress was designed: *precision destruction by daylight, in areas where the going is toughest.*

It is not an easy task. The Germans tried it in the Battle of Britain, and gave it up as too costly when 185 of their own planes were shot down in a single day.

The Fortress is engineered to perform superbly at altitudes of more than 7½ miles; it bristles with effective firepower; and it can absorb such punishment, and still keep flying, that the Germans have even devised special rocket-gun fighters in the vain attempt to drive it from their skies.

Fortresses are lost, of course . . . sometimes many of them on a single mission. But a recent check shows that over a 12-month period, an average of more than 95% of them have returned from each attack. Their stout-hearted and superbly trained crews have never yet been turned back from their objectives by enemy opposition!

• • •

To produce a plane like the Fortress requires unusual qualities of research, design, engineering and manufacture. You can expect these same qualities in the peacetime tomorrow, knowing that any product "Built by Boeing" is bound to be good.

DESIGNERS AND BUILDERS OF THE FLYING FORTRESS • THE NEW BOEING B-29 • STRATOLINER • TRANSOCEAN CLIPPERS **BOEING**

The Fortress sticks its chin out

Flying Fortresses have always been tough—ask any Nazi fighter pilot.

But today they're tougher than ever, with a new chin turret that juts out defiantly with deadly machine guns.

The free movement of the guns must be protected against the elements and the cold of the sub-stratosphere. And they *are* protected—by a zipper. By Crown's revolutionary, new double-acting zipper that moves in either direction. When a gun is raised or lowered, the zipper opens ahead of the barrel while simultaneously closing behind it. And no amount of ice can ever cause it to freeze or jam.

This amazing two-way zipper won't lock "open." It's practically indestructible—and so reliable that it's used not only on gun turrets but on airplane engine covers, half-track tops, tent shelters and other military applications where life depends on instant and unfailing action.

After the war, *you'll* be using this new zipper that works every time and both ways. You'll find it in all sorts of civilian applications, bringing you undreamed-of convenience and reliability. Look for it.

THE ZIPPER OF TOMORROW

CROWN ZIPPER

The Spool Cotton Company · 745 Fifth Avenue, New York, N. Y.
(Crown Fastener Division)

Cessna Test Pilot, who has flown a MILLION MILES

RIDES WITH *Romec!*

"I have flown a distance equal to 40 times around the world As a CESSNA Test Pilot I can say that the positive displacement, non-pulsating ROMEC fuel pumps, and the ROMEC vacuum instrument pumps are darned good pumps. In fact, they improve the dependability of the CESSNA—the finest trainer made"

Carl D. Winstead.

ROMEC salutes Carl Winstead for his million mile record and the CESSNA AIRCRAFT COMPANY which has made a splendid record in building fine trainers which have helped to make the American Air Forces the finest on the fighting fronts.

BUY WAR BONDS

ROMEC PUMP COMPANY · ELYRIA, OHIO, U. S. A.

Manufacturers of Aircraft Pumps and Accessories

Air War's Test Tube

(*Continued from page 32*)

achievement there are several interesting features. The defeat of the highly-touted Zero fighter was one. This plane, easily and cheaply built, was the terror of the early months of Pacific air fighting. Weight, armor and strength had been sacrificed to produce a versatile, all-purpose, all-altitude pursuit ship which was heavily armed with cannon and machine-guns. Its opponents in the first months of the campaign were Brewster *Buffaloes*, Curtiss *Warhawks* and obsolete Australian *Wirraways*. Except in the case of the *Warhawk* fighting at medium altitude, it didn't have much to beat.

At this stage all of our planes were heavily outnumbered, and the Zero employed high-level tactics against which the *Buffaloes* and *Wirraways* had no counter at all—and the only way in which the *Warhawk* could get out of trouble was by diving out of it. When we did obtain victories it was because of our superior skill. Col. Boyd ("Buzz") Wagner, flying *Warhawks* and *Airacobras* against the Zeros, became the first Pacific "ace" not because of superior planes but because he was tops in courage and one of the greatest marksmen of modern air fighting. The Zeros could not take punishment and one or two good bursts usually were sufficient to add another kill to the Allied total.

The next opponent of the Zero was the *Airacobra*, again handicapped by a low ceiling and actually the least successful of all our performers against the Zero, despite its cannon armament. After 10 months of heavy air fighting in New Guinea it was significant that the best record against the Japanese fighters was held by the *Warhawk* which, with all its limitations, was a well-loved plane by every pilot who flew it. By this time the Zero had been beaten completely by Allied fighters operating at three levels—the *Airacobras* low down, *Warhawks* at medium and the new *Lightnings* right up top.

The *Lightnings* had a few weeks of bad performance when young pilots were trying to iron out the bugs. Then one day they smashed into a large Zero formation and almost completely annihilated it. From that day the *Lightning* was the outstanding killer of the New Guinea campaign. The Japs swung a new model square-winged Zero into the fray but it seemed to be less of a menace than the original Zero.

An important contributing factor to our recovery of fighter command of the air was the performance of the *Fortress*, which was so deadly in combat with the Japanese fighters that the enemy pursuit strength suffered repeatedly from attrition and loss of morale. It was common for a single *Fortress* to be attacked by from 12 to 16 Zeros, and to come home safely after having shot down five or six of them.

In the first raids on Rabaul the *Fortress* was used in attacks from 26,000 to 30,000 feet. At such altitudes weather conditions in the tropics were almost never suitable for accurate bombing. The *Fortress* was then used with much more success as a medium level bomber and, later, with the perfection of "skip-bombing," they became low level night bombers able to attack with deadly accuracy from heights only 200 or 300 feet above the targets.

Marauders, which had performed magnificent service in the critical days and had inflicted—and suffered—heavy losses in their gallant daylight raids at extreme limit range on Rabaul, had been more or less withdrawn from combat operations because few of the planes which still survived were sufficiently airworthy for active operations. *Mitchells* had taken their place and after certain improvements to their armament they showed themselves to be splendid medium bombers. The first dive bomber tested in the Southwest Pacific—the Douglas *Dauntless*—had its good days and its bad, but was too vulnerable to Zero interception and was withdrawn. It has since been replaced partially by the Vultee *Vengeance*. The Allies also used two of the world's finest low-level attack planes which, although not strictly dive bombers, served much the same purpose. They were the Douglas *Havoc* (slightly redesigned on the spot to carry a more lethal load of bombs and a devastating forward firepower) and the British Bristol *Beaufighter*. The *Beaufighter*, with its quiet engines and stealthy approach, could easily outstrip the Zero at the altitudes below 500 feet from which it always attacked, and its bristling gun armament of four cannon and six heavy machine-guns created havoc among Japanese ground positions and small shipping. *Fortresses* and *Liberators* continued to carry the weight of the general heavy air offensive.

With this force Lieutenant General Kenney kept carrying out the policy of attack that MacArthur consistently urged —"Hit the Jap with whatever you can whenever you can!" Every attempt by the Japanese to recapture air supremacy was anticipated, met and shattered. Ground campaigns in New Guinea produced victory after victory for MacArthur's men because they fought under the protective umbrella of an alert and courageous air force, still weak numerically but never lacking in courage and high morale. After Buna had fallen, Maj. Gen. Edmund Herring, commander of the Australian New Guinea force, said: "Australia can never fully appreciate the debt she owes to the Fifth American Air Force!"

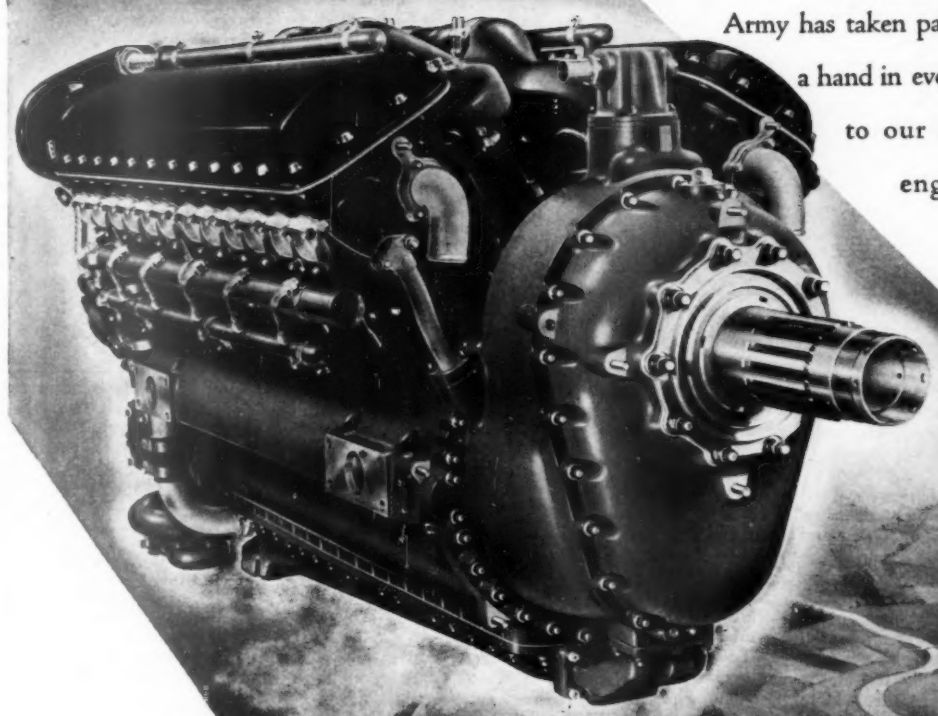
Aviation history was made in the campaign which smashed the Papuan invasion force of Gen. Tomatore Horii. For the first time in any war an attacking army was transported, fed, supplied, supported and maintained by an air force for a period of several months. The army fought without motor transport (part from the jeeps that were flown into battle areas), without the Air Service Command, without field ambulance services or any of the other ancillary features usually deemed indispensable to military operations. It moved and fought without ships, trains or trucks. Their place was taken by army transport planes and even by civilian airliners dragged from Australian main routes for the emergen-

FLYING

"I understand Amalgamated Toaster has taken over production of this model."

THE ENGINE THAT IS ALWAYS THERE

Allison-powered planes have been called upon in every major engagement in which our Army has taken part. ★ They have had a hand in every great land victory to our credit. ★ Allison engines always—for dependability and brilliant performance!



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LIQUID-COOLED AIRCRAFT ENGINES

Allison
DIVISION OF GM GENERAL MOTORS

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KEEP AMERICA STRONG
BUY MORE WAR BONDS

POWERED BY ALLISON:

P-38—Lightning • P-39—Airacobra • P-40—Warhawk • A-36 and P-51—Mustang

cy. These unarmed planes, flown across the terrible Owen Stanleys and through Zero-infested skies by incredibly courageous young pilots, altogether transported more than 1,000,000 tons of food, ammunition and supplies through almost constantly bad flying weather and over a mountain range with peaks soaring to 13,600 feet. (This is equivalent to about 1,000 American freight trains of 40 cars each.—Ed.) The planes covered distances which varied from 100 to 1,000 miles. The Luftwaffe's airborne invasion of Crete was child's play compared with this colossal feat, yet it worked without a single hitch and was the main factor which drove the Japanese out of the Owen Stanleys and annihilated them at Gona and Buna.

Within a few weeks of the termination of the Papuan campaign came the ultimate triumph of properly employed air power. In the Japanese subsidiary garrisons at Lae and Salamaua troops were starving because the Allied air blockade had prevented supply ships getting through for three months. Under cover of a heavy weather front the Japanese moved a convoy of 12 large transports with an escort of 10 light cruisers and destroyers from Rabaul.

The move was anticipated and countermeasures planned for several days in advance. Every Allied plane was grounded and given a thorough overhaul. At the right moment the Australian *Beaufighters* went in to strafe the decks of the Japanese ships to soften up antiaircraft defenses. *Mitchells* and *Havocs* came in for low-level skip-bombing attacks. *Fortresses*, protected by top cover of *Lightnings* and *Warhawks* thundered overhead at 6,000 feet.

We attacked in small formations—never more than 12 planes at a time. At no time did we have more than 40 aircraft above the convoy at any one time. The Japanese Zero screen numbered 150 fighters. Throughout the whole two-day attack we used a total strength of 138 bombers, fighters and attack planes. Every unit of our first-line air defense was employed and, after the first day, ground crews worked all night on repairs, getting one good plane out of three crocks, so that our best strength could be sent into the air next day. It was a wild scramble in which improvization played the major part.

By sunset next day the first 100 per cent victory of air power over sea power had been achieved. Every Japanese ship had gone to the bottom. Only a handful of the 15,000 to 20,000 soldiers and sailors aboard the ships had survived to reach the shore. And approximately 100 of the 150 "protective" Japanese fighters had been shot out of the sky. More recently an entire enemy air force has been annihilated at Wewak by a similar form of co-ordinated air attack.

These attacks show clearly what will be done against Japan when the time comes to throw the full weight of Allied air power against the common Pacific enemy. In the southwest Pacific so much has been done by so few with so little, that the Japanese must realize by now the dark days that lie ahead of them—the day when the great weight of Allied aviation is turned against their faltering war machine and against the scattered bases which they gained by the employment of surprise and treachery. END

Short Snorter

(*Continued from page 57*)

No. 1 authority, Clyde Pangborn, says: "Back in the days of the Gates Flying Circus, we landed our troupe in Syracuse (New York) during the first week of September, 1925. After a particularly successful engagement, when more cash came in from the admission gates than we had to pay out for gasoline, Gates and the boys decided to throw a party for the press and really celebrate. Champagne seemed in order so Jack Ashcraft (killed in a crash a few years ago), a pilot-member of the circus, volunteered to fly to nearby Hammondsport for a case of the giggle water. Whether it was the altitude or whether Jack just decided to sample the stuff on his way back, will never be known. In any case, when he landed both he and the plane were well loaded. He rushed up to me and, in a belligerent tone of voice, demanded to know whether or not I was a 'Short Snorter.' It was all pretty vague to me but in order to quiet Ashcraft and at his insistence, I finally produced a dollar bill which Ashcraft signed with a big flourish and handed back to me with the words 'Now you're a regular Short Snorter.' And from there on it just grew."

The second authority, E. W. 'Pop" Cleveland, says:

"The Short Snorters made their appearance in 1928, just before the air races at Mills Field, Los Angeles. The cause of it all was Bob 'Short Snorter' Garland. Bob was always willing (see department of understatement) to break down and have what he called a 'short snort' with any of the flying fraternity who might be ordering the drinks. Whenever it came Bob's turn, however, he'd pull out a $1,000 bill which no bartender, in those days, was ever able to break. The only defense against that strategy was to get the bill out of circulation. To do this, the boys started putting their signatures on it, since they were convinced it was never going to be spent anyway. Just to get even with Garland (the blankety-blank short-snorting blankety-blank—Pop's language always being picturesque), some of the gang began to autograph dollar bills for each other—the dollar bill which was not being used to buy Bob Garland a drink."

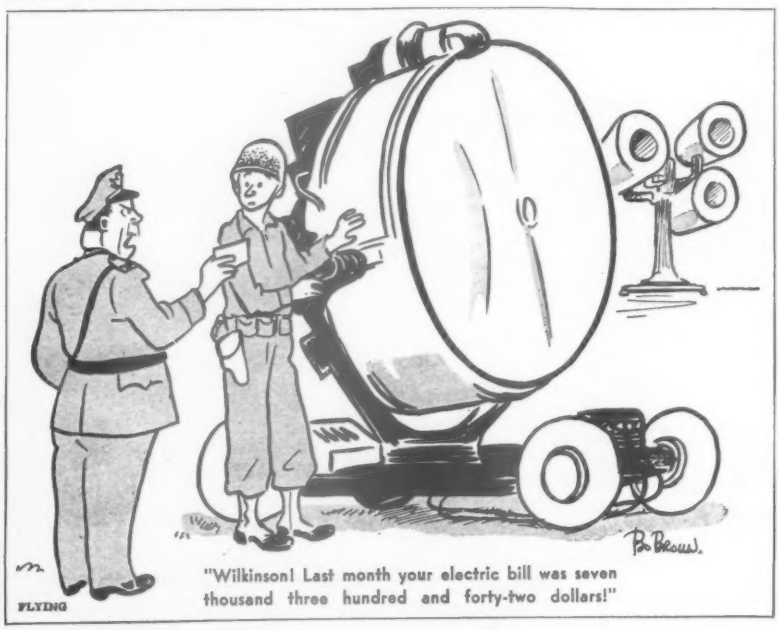
In that Los Angeles group was Jerry McClellan, the mathematical wizard, who figured out that if two pilots were ever stuck together at a time and could collect an extra buck from an innocent third party they would, over a period of years, get back the dough they had paid out for Garland's drinks. The initiation fee would make each victim a Short Snorter on his own. This system, it is reported, worked well during the 1928 air races.

In the depression, alas, there weren't a dozen full-fledged Short Snorters who were able to keep their bills on their person and the Short Snorters passed quietly out of the records.

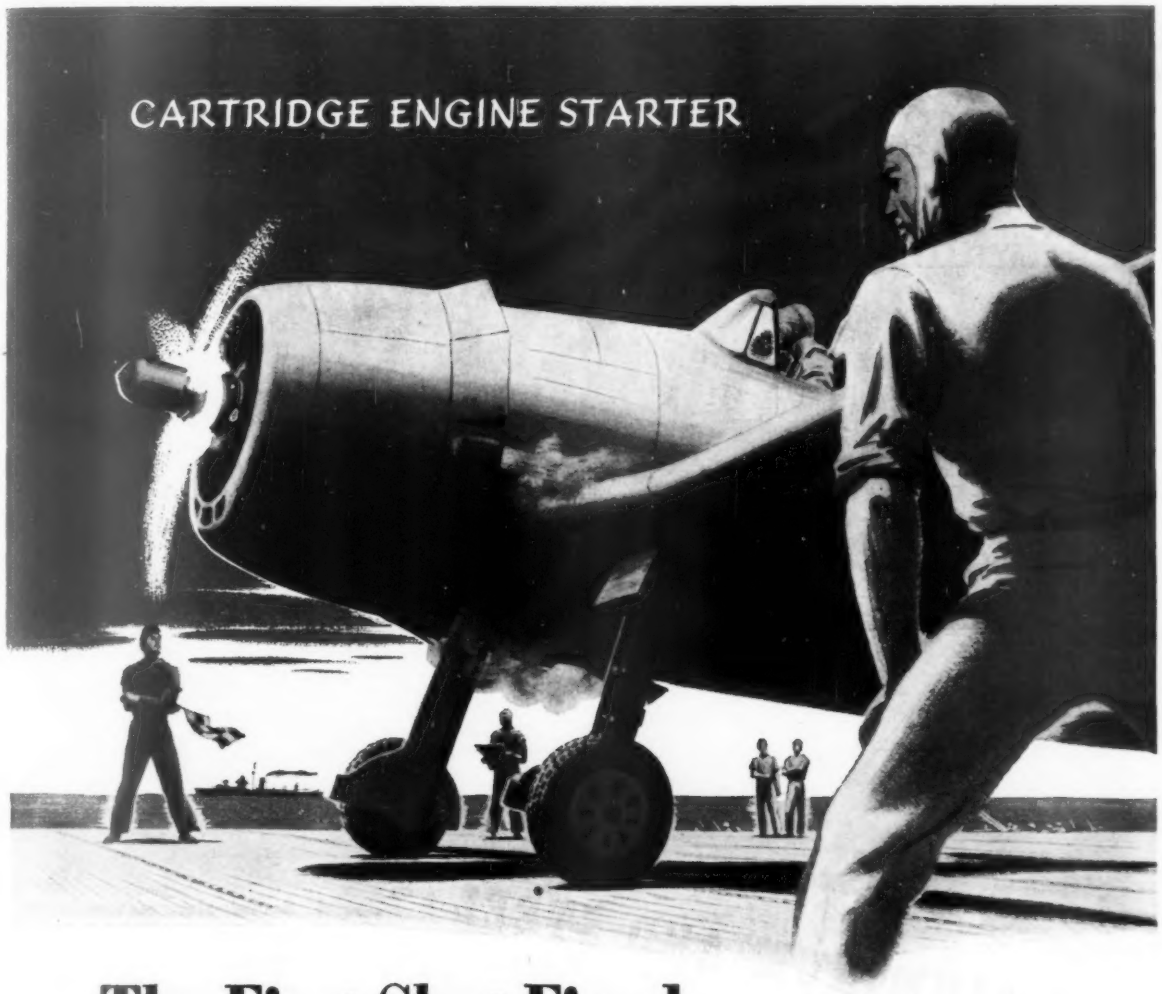
But the great tradition remained alive, through a strange coincidence, in, of all places, Alaska!

There, in 1930, Wiley R. Wright (now Lieut. Col. Wiley R. Wright, U. S. Army Air Force, Seattle Area Supervisor)

(*Continued on page 132*)



"Wilkinson! Last month your electric bill was seven thousand three hundred and forty-two dollars!"



The First Shot Fired

For Lightning-fast Getaways, Navy Fighters Depend on Breeze Cartridge Engine Starters

Operating on the same principle as the familiar spiral-drive screwdriver, the Breeze Starter spins engine over at 180 RPM, under 30-ton thrust developed by slow-burning cartridge fuel.

Manufactured under Coffman Patents

THE first shot fired in modern combat is the charge in the breech of a Breeze Cartridge-Type Engine Starter, spurring latent horsepower into instantaneous life, smoothly and without shock to engine parts. From arctic to tropic theatres, these starters are relied upon for quick getaways without the use of auxiliary starting equipment, out of the question on flight decks.

Simplicity of design and rugged construction make service problems virtually non-existent in this type of starter. Saving as much as 20 lbs., the Breeze Starter also obviates the use of heavy starting batteries. Delivering more than a foot-TON of torque from a 2 oz. cartridge, Breeze is the accepted starter for the big fighter engines today, is ready for higher power of tomorrow.

BREEZE

Breeze

CORPORATIONS, INC., NEWARK, N. J.

PRODUCTION FOR VICTORY • PRODUCTS FOR PEACE

FULLY EQUIPPED AND MANNED.. for fast production of AIRCRAFT PARTS

IN ALUMINUM AND STEEL..

● LYON'S modern, completely equipped Aircraft Division . . . under the supervision of men specially trained in aircraft plants . . . is constantly widening the scope of its production of aircraft parts and sub-assemblies. The facilities of this specialized division include:

1. Class "A" certified welders trained in our own school.
2. Toolroom equipment and personnel for producing dies, fixtures and jigs to meet contract requirements.
3. Highest financial rating.
4. Sound, alert management . . . with demonstrated capacity for setting up production plans on dissimilar parts and sub-assemblies.
5. Complete familiarity with Air Corps, Navy and other Government inspection requirements.
6. War contract experience dating from July, 1940, covers over 2400 contracts from 30 states. 43 years' experience in fabricating sheet metal.

Lyon's Extensive Production Range Includes:

Hydropress work ● Brake forming operations—aluminum and steel ● Hydrogen, acetylene and electric spot welding ● Routing, swedging and shaping operations ● Painting ● Fabric covering, including doping ● Magnaflux inspection equipment ● Sand blasting ● Alroking ● Complete assembly work, including both welding and riveting.

Write on your business letterhead for detailed information and book, "Craftsmen in War Production."

LYON METAL PRODUCTS, INCORPORATED.
General Offices: 268 Madison Avenue, Aurora, Ill.
Sales and District Offices Manned by Experienced Engineers in All Principal Cities

LYON METAL PRODUCTS, INCORPORATED

For the next 20 seconds, the pilot's name is Elmer!

APPROXIMATELY 20 nervous seconds elapse between the time a bomber goes into its final run and the time it pulls out and heads for home.

During these vital 20 seconds, which determine whether the mission succeeds or fails, the pilot of this bomber is a machine—the Sperry Gyropilot.* He's "Elmer" to the U. S. bomber crews —"George" to the fliers of the R.A.F.

Why is the plane turned over to Elmer? Because Elmer provides the precision control necessary to maneuver the airplane correctly during the bombing run.

Elmer holds the ship steadier—truer —than any man can do. His errorless control is one of the big reasons for the accuracy of American precision bombing.

Elmer not only does this but, going to and from the target, he can hold the big ships in level flight and on their course with no hand on the controls.

Naturally, a device like this is not created overnight. Sperry developed the first automatic pilot before the last war. It was designed to increase safety in flight. Pioneering and development work continued. In 1933, Wiley Post flew around the world alone with the aid of a Sperry Gyropilot.

Post's epochal flight furnished spectacular proof that Elmer was practical. Sperry Gyropilots were soon standard equipment on transport planes the world over. When World War II came, still further improvements had been made to give Elmer the precision needed for bombing missions.

Improvements are still being made. When the war is over, Elmer, along with many other Sperry devices developed for peace and adapted to war, will return to the work for which he was originally designed.

With more than 30 years of development behind him, Elmer, the Sperry Gyropilot, will be well-equipped to serve tomorrow's world-wide airlines.

American bombers are now being equipped with the new Sperry Gyrotronic Pilot, a precision, electronic version of the Gyropilot.**

*Trademarks Registered

SPERRY

GYROSCOPE COMPANY, INC.

Brooklyn, New York

Division of the Sperry Corporation

(*Continued from page* 128)

started the second Alaskan Gold Rush when he stepped off a Fairchild in Fairbanks. The tall-tale tellers of the north country had shaken Wiley down on every subject he could think up and he retaliated by conducting indoctrination classes in Short Snorting and initiating new members right and left—for the traditional initiation fee, naturally. There is some question about his violating the canons of the organization by conducting initiations alone but the board of directors, recognizing his enormous contribution to their group, has chosen to ignore it.

"The system survived in Alaska," the colonel says, "because we really took it seriously. We were mighty choosy as to whom we'd accept as a Short Snorter. It was tough enough to become a Sourdough. But to become a Short Snorter was even tougher. Only pilots, in the first place, were eligible—and even pilots had to have a long record of accomplishment before they could join the charmed circle."

As Colonel Wright tells it, the boys would ambush each other under the northern lights. If a member was caught without his bill he paid—plenty. Once Joe Crosson caught the boys on a picnic and collected from every one of the 34 present. One night they cornered Wright himself in the Model Cafe in Fairbanks. He kept stalling, meanwhile edging toward the back door of the cafe, then made a break for it and raced down the block to the Nordale Hotel, grabbed his wallet, and was back in the cafe before they could get organized. He made the run in two minutes flat and ever since that day Rule No 6, based on his timing, has been in effect: "The challenged is allowed two minutes in which to produce his bill before a fine may be levied."

When Wiley Post and Will Rogers were in Alaska in 1935, Will felt so bad about not being "one of the bunch" that they finally broke down, took a vote, and agreed to allow him in "by acclamation." It cost Will $23, there being 22 members present, but he said he'd have paid $1,000 apiece if they had been conniving enough to ask him for it.

Until about 1935, the Short Snorters were pretty well confined to Alaska and the rules and regulations of the club were first codified up there. And from this source, where it had been preserved so long in the shadow of the Arctic Circle, Short Snorting came back to the States. Pan American pilots, who had flown in Alaska since 1932, were transferred to Miami and there, when their benumbed brains had thawed out, they began to get ideas.

One of the earliest to be indoctrinated had been Joe Crosson. When he discovered 134 Pan American pilots—more flying men than he had ever seen in one spot in his life before—he was reported to be in a frenzy until another Short Snorter happened into Miami. There the two of them (as required by the rules) opened shop and began wholesale initiations. The report spread like wildfire and in no time pilots from Peru to Patagonia were pulling Short Snorter bills out of their wallets and challenging anyone who came down the pike.

Money will have a way, and it was a short step from there to a broader interpretation of that careless word "flyer" in the rules. The rule didn't say "pilot" did it? Before long, old-time passengers who could boast of a flight around South America began turning up with Short Snorter bills. Then passengers who had flown across the Caribbean were let in. Later the rules were let down another notch so that any passenger who had made a day's flight was eligible. Finally (alas) the Short Snorter tradition became so popular that practically everyone who managed to get aboard an airplane—and who had the necessary bucks in his pockets—was initiated into the fold and left perspiring and poorer—but pleased. Suckered and proud of it.

Before the magnificent Short Snorter tradition had been so ruthlessly debauched by gold-hungry initiates, any number of famous people had enrolled—and paid. Many members of King George VI's family are on the list, though it is not known whether the king himself is a member. The roster also boasts other royalty—Queen Wilhelmina of the Netherlands, King George of Greece, Prince Olav of Norway.

President Roosevelt was inducted enroute to the Casablanca war conference last year—it cost him $7 and he still owes five crew members $1 each for his initiation because they politely withdrew when it became apparent that the President was a little short of change. Harry Hopkins is reported to have gotten in for $6.

The story may be apocryphal, but it is said that the President has managed to buy several war bonds with the proceeds he has picked up as a result of his challenges to Short Snorters who called on him without having their bill handy. It cost Wendell Willkie $17 to become a Short Snorter.

And to timid souls who are doubtful about putting their names on Uncle Sam's money, Mr. Van Dusen is happy to report that the practice is not so illegal as to keep Henry Morgenthau, Jr., himself from being a Short Snorter in good standing. END

Madame Mechanic

(*Continued from page* 58)

train specialists to handle 256 different airplane types and modifications, 157 different types and modifications of engines and more than 1,000 different accessories. Indicating the complexity of modern war, San Bernardino Air Depot alone now handles 80,000 different supply items, will soon be handling many more different items.

Each recruit then is given a series of four-hour "experiences" in each of 19 specialties of aircraft mechanics. These include carburetors, aircraft disassembly, ignition, engines, fabric and leather, hydraulics, instruments, machine shop, paint and dope, drafting wood shop, Army-Navy standards, sheet metal, welding, wire cable, fuel and oil systems, aircraft electricians, brakes and measurements.

This marks the first time in industrial history that such a broad introductory program has been applied to the training of mechanical talent. Many advantages result from giving newcomers such a complete picture of the new work they are entering. Industrial foremen have normally been plagued by worker unrest. Workers have a persistent penchant for "greener fields far away." The payrollee's universal desire seems to have been to try to find a more glamorous or lucrative job than his own. This new system gives the rookie a chance to try everything before choosing his specialty. That enables him to select what he prefers and to ascertain the work best fitted to his talents and his knowledge. Having first tried all the jobs, he will not dream later of what he thinks he has missed. That means he will be more satisfied, more efficient and more useful.

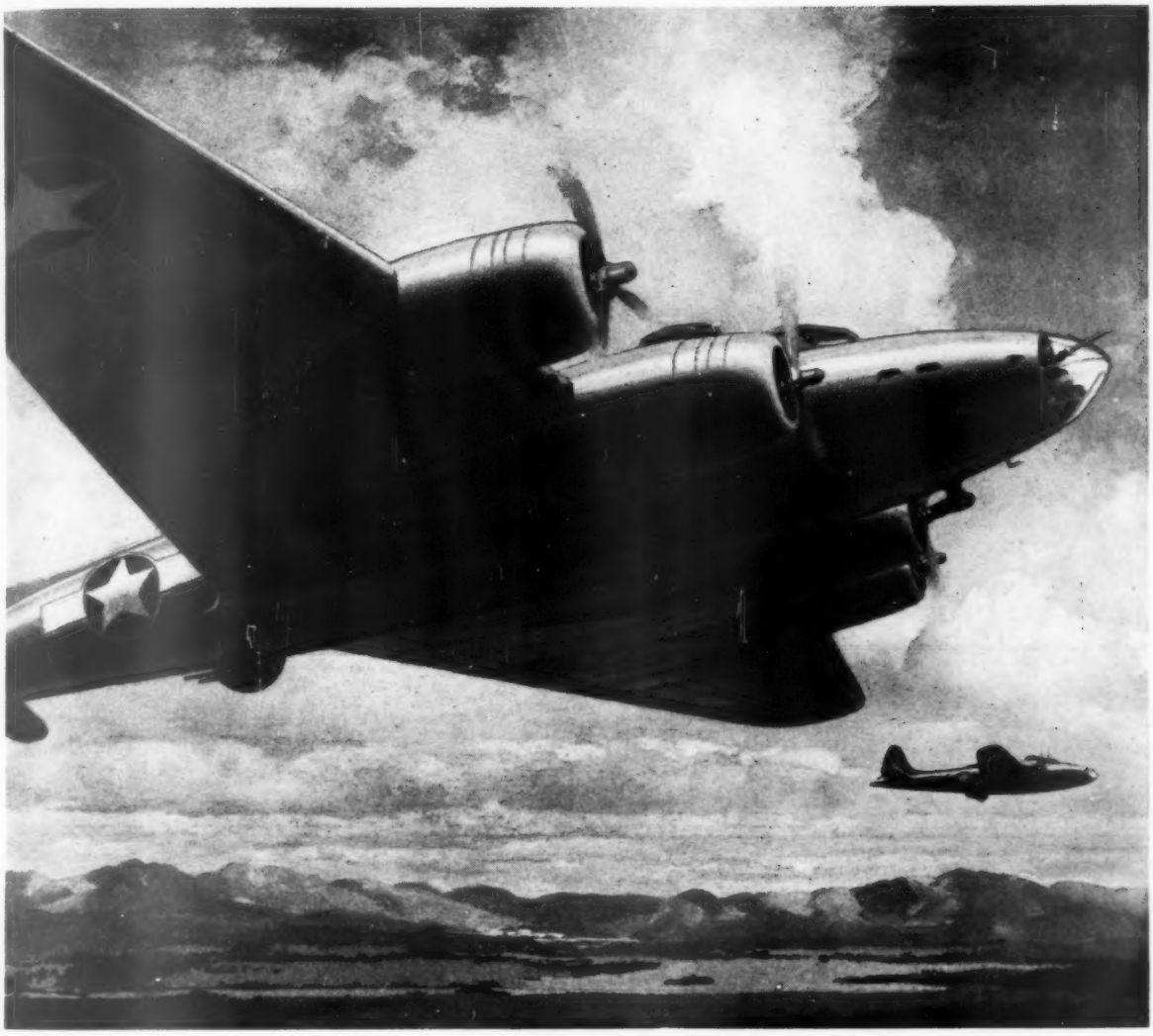
Each worker is rated by his results in actual performance in these four-hour experiences, plus his results in a battery of tests and his personal choice of a specialty to follow. The tests given include vision, intelligence and mechanical aptitude. The recruit is allowed to make three personal choices in an interview with a counsellor. On the basis of these factors, he is assigned to a specialty and given an intensive specialized course lasting from two to four months.

Innumerable little human anecdotes arise from this training operation. One woman bleated with dismay when she observed that she was to do "horrid mechanical work." She was prevailed upon to give it a try, and soon found that she liked it better than any other work she had ever done. She grew to so excel at the "horrid mechanical work" that, in time, she was made an instructor to teach this art.

San Bernardino Air Depot's ingenious training department and its curriculum were perfected under the direction of Maj. Homer Fetty, depot civilian training officer and former vocational educational director of the Los Angeles County schools. In that capacity, before joining the Army, Major Fetty organized specialized training courses in dozens of public schools to train skilled specialists for the aircraft manufacturing and shipbuilding plants of Los Angeles. Today those same plants, so many of whose workers were trained under his direction, are sending delegations to Major Fetty's operation at San Bernardino to study techniques which they might adopt to expedite production and training methods.

Another big problem at San Bernardino has been to get more workers. It is primarily a recruiting problem, to make known the need and to familiarize more

(*Continued on page* 136)



Swarms of Flying Fortresses fly on Studebaker-built Cyclone engines

THE skies are studded with Flying Fortresses in many theaters of this global war. Almost legendary are the achievements of our Army Air Forces with this devastating Boeing bomber—and any manufacturer would be glad to play even a minor part in the victories it is rolling up. We, of Studebaker, have the responsibility of producing huge quantities of the Cyclone engines that power the Flying Fortress, enabling it to travel so fast, so far, so high. Each of these supercharged engines we build adds new luster to a Studebaker reputation for sound craftsmanship that now spans more than 92 years. Studebaker equipment at the battle fronts will be succeeded, one day by new and finer Studebaker cars and trucks for civilian use. Until that day, our first and only consideration is helping to arm our Nation and its Allies.

Awarded to Aviation Division ARMY-NAVY E *of The Studebaker Corporation*

Tens of thousands of multiple-drive Studebaker trucks for the United Nations
—Studebaker, famed for years for dependable transportation has now become one of the world's largest builders of big war trucks.

★ BUY U. S. WAR BONDS ★

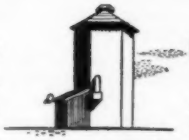
Studebaker BUILDS CYCLONE ENGINES FOR THE BOEING FLYING FORTRESS

ARMY
E
NAVY
FIRST . . .
Hallicrafters has the honor of being the 1st exclusive radio manufacturer to receive the Army-Navy Production Award for the 3rd time!
BUY MORE BONDS!
hallicrafters
The World's Largest Exclusive Manufacturer of Short Wave Radio Communications Equipment

Moving heaven and earth to train Air Navigators

BENEATH the roof of a forty-five-foot "silo," a bomber crew is *en route* to the "target." Above, is a skyful of "stars." Below, the terrain rolls past in full detail. Every significant element of flight is present. This is the new Link Air Navigation Trainer, in which pilot, navigator, bombardier and radio operator practice every phase of air navigation — contact, dead reckoning, radio direction and celestial. It appreciably shortens the time required to perfect United Nations air crews in the technique of navigation.

Kollsman's contributions to this unique new trainer include a group of special navigation instruments and the teletorque remote control units which "report" every movement of the "plane" to the control desk below.



Pin-Point Global Navigation

At the top of the "silo" is a celestial dome with accurately spotted stars constantly changing position in relation to the passage of time and the movements of the plane. Sextant sights on these stars permit fixes accurate to within five miles. Below the plane a moving terrain is projected photographically. Effect of wind velocity can be introduced, requiring drift sights.

At the control desk on the floor of the "silo" the familiar Link electric "crab" records the track of the plane while special Kollsman instruments report its changes in latitude and longitude and keep track of sidereal time, solar time and the Local Hour Angle of Aries. Radio signals of all types are sent to the plane during "flight." Any type of navigation problem can be "set up" from this control center.

KOLLSMAN AIRCRAFT INSTRUMENTS

PRODUCT OF

SQUARE D COMPANY

ELMHURST, NEW YORK • GLENDALE, CALIFORNIA

(*Continued from page* 132)

people with the fine training provided. The program is temporarily handicapped by a housing shortage which complicates the problem of bringing in people from outside areas. That makes it necessary for a finer combing of the home field, which also must man the war industries of all Southern California, one of America's leading war-production centers.

The unskilled civilian workers are all hired by the United States Civil Service Commission at $100 a month, plus overtime, and routed through the base civilian personnel office into the training division. They may work up through successive steps to better positions and higher pay scales.

Mechanics and workers for the ASC receive the benefits of civil service, including 26 days vacation with pay per year, 15 days sick leave, and civil service retirement. They are given training which prepares them thoroughly for post-war work in the aviation industry, which business thinkers expect will prime the nation's peace economy as transportation did after the last two major wars: railroads after the Civil War, automobiles after the first World War.

The war is teaching that many women have exceptional mechanical aptitude and can operate ponderous and complex machinery, sometimes more skillfully than men. They also become expert in the repair of delicate instruments, with which instrument flight through fog and overcast is accomplished. War teaches that the old are still fit to work, and work wonderfully well. War teaches that the seemingly uneducated can be schooled to operate machinery and repair aircraft, the loss of which would otherwise delay victory. War teaches that nearly every man and woman can be used, and we are using many thousands of them. Many sociological thinkers believe that the social effects of these lessons that we are learning today may be more lasting than victory.

Training procedure is divided into two major fields. Maintenance (doing actual work on aircraft and equipment), occupies two-thirds of all the employees at an air depot. For this specialty alone the training section of the San Bernardino Air Depot has more than a million dollars worth of the finest and most modern equipment.

Second branch of the training work is supply and clerical. People are trained to handle items of all different descriptions and purposes, ranging from paper clips to huge engines. The training program for supply consists of specific job training for shipping clerks, storekeepers, receiving clerks, stock record clerks, inspectors, mail file and record clerks, purchasing and contracting, personnel, and inventory clerks and other miscellaneous clerical positions.

Special advanced training is given for the hundreds of supervisors who oversee phases of the air depot's maintenance and clerical work. A "supervisor" has three or four persons under him. Since most of these supervisors have had no previous experience in handling people and directing work, it is a major problem to prepare supervisory talent for an establishment that has mushroomed so rapidly.

San Bernardino Air Depot has developed an intensive supervisory training program with a minimum of 52 hours. The three divisions of this course are job management, problems of handling employees and how to instruct. Details covered include how to plan, set up, direct and control an operating organization; how to handle the shop problems as they arise, including personnel problems, grievances and introducing new workers to new jobs; how to do "on-the-job" training efficiently.

Methods of handling men, methods of training and safety factors are stressed throughout the course. This training program has proved to be an effective aid in the solution of the difficult supervisory dilemma.

San Bernardino's training program includes also an extensive teacher-training program for its several hundred instructors. It is the fountainhead of an educational network which has special off-reservation classes and up-grade training programs in many educational institutions and sub-depots through the three states of the San Bernardino Air Depot Control Area.

In the technical training progress of the Air Service Command is evolving the basis for post-war procedures for training the millions of mechanical specialists who will keep the "eagles of peace" in the skies of tomorrow. END

Miniature Air Force

(*Continued from page* 51)

explained. "The models proved impossible to standardize. But once plastics were used, each model had to be exactly like every other similar model. There could be no room for individual differences because each is made from the same die."

At first many model planes were molded from hard rubber. These proved generally unsatisfactory, especially in the large models, because the material does not hold its shape. It has a tendency toward what plastics manufacturers call "plastic flow." Next, models were made of metal, which produced an accurate job if the die were cut satisfactorily. But metal models are very heavy, weighing nearly 10 times as much as plastic. The weight was a special disadvantage in shipping because the need for models has been so urgent they often are shipped by air. Metal planes also break when dropped—are far less durable than the plastic models. Besides, metal is scarce.

Subsequently, planes were molded of a reinforced plaster compound. This did not make a perfectly clean job; the appearance of the finished plane was apt to be lumpy and plaster models shattered when dropped. Since they are shipped overseas and must stand rough handling in transit, to say nothing of the handling they get in actual use, plaster models have proved unsatisfactory.

The cellulose acetate plastic models developed by Cruver seem to be the best so far. Only a tenth the weight of diecast metal models, capable of taking hard usage and being shipped without danger of breakage, they have another important advantage—they can be manufactured rapidly. This was especially important in the days when the armed forces were desperate to have model planes by the hundreds of thousands.

A single mold can produce from 35 to 60 model planes an hour compared with a much smaller production of plaster of Paris model, and tremendously fine detail is achieved. The plastic does not appear to deteriorate from age.

The Cruver company is also responsible for making the original master models to be reproduced. The Army and Navy furnish silhouettes, photographs, dimensions, and occasionally sketches of the original plane. Skilled model makers, accustomed to working with no more than the clues offered by the photographs and silhouettes, then proceed to carve the master model by hand from wood. The completed master model is then sent to the Army and Navy for approval. Once approved, dies are made and the planes are ready for production.

Cellulose acetate is known as a thermoplastic material. When heated it undergoes a physical change only. The advantages of cellulose acetate in making model planes are (1) it is quite strong, (2) it is flexible, which gives it a high impact strength and (3) it is extremely resistant to most weather conditions. While it tends to absorb a small amount of moisture this is not a particular disadvantage in model plane construction.

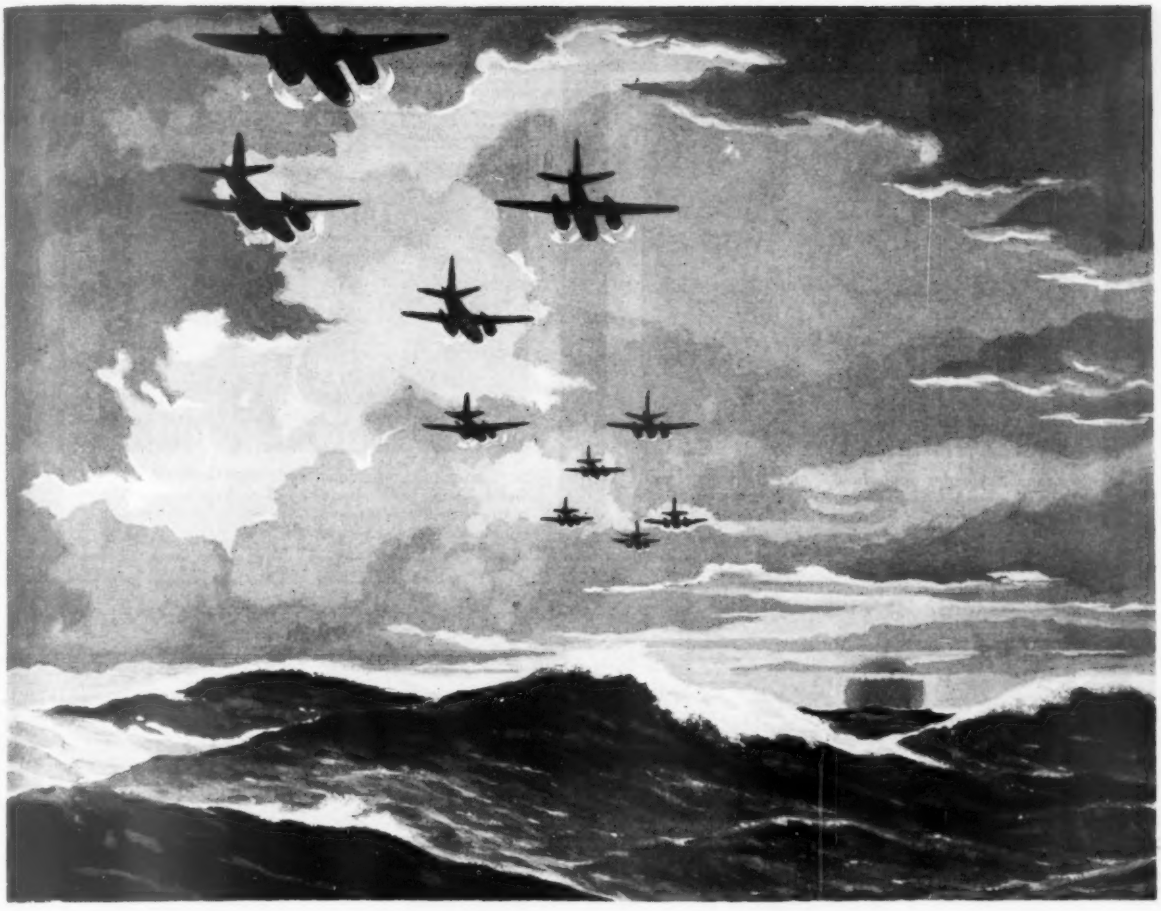
Before being molded, the cellulose acetate (the same material from which some rayon is made) is in granular form and may come in any color. Black is the common color used for aircraft recognition models. However, a few special models have been made of white plastic painted black except for the plane windows, producing a remarkably true-to-life job.

The granular plastic is placed in a molding machine and heated, upon which it assumes a fairly viscous state with the consistency of molasses. This material is forced into the die at a pressure of about 30 tons per square inch—enough to force the slow-flowing material into every crevice and groove of the die.

The die then is cooled in water, the time of cooling varying with the size of the model plane (a *Lightning* might take about three-quarters of a minute), the temperature, and the humidity. Although the models could be made in automatic machines they usually are taken from the die by hand and immersed in water to cool and harden them further.

The rough models then are cleaned up. The gate through which the plastic en-

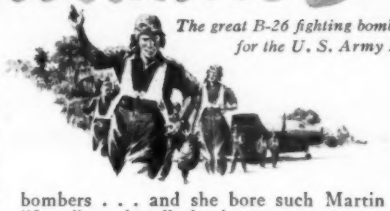
(*Continued on page* 140)



MARTIN

IT'S CALLED THE *Marauder* — A MAN MADE TORNADO!

The great B-26 fighting bomber built by the Glenn L. Martin Company for the U. S. Army Air Force and The British Air Forces.



TWO years ago, on the day after Pearl Harbor, a group of Army B-26's headed west . . . their destination, Australia. When the Jap offensive reached New Guinea, these B-26's went into action. In two months they wrought terrible havoc to Jap ships, bases and installations, with an extra dividend of 97 Zeros downed at a cost of 6 Marauders. Result — the Jap juggernaut shuddered to a stop.

The secret of the Marauders' success? Look at one and you'll see a plane born to fight. It's a plane with a chip on its wing!

15 Tons of Flying Fury

That, Martin men say, was the Marauder's one fault. It *looked* too good to be true. At its unveiling in 1940 skeptics shook ominous heads. Too fast, they said, too "hot," too radical. In those days Germany's slow, ungainly Junkers epitomized "bomber."

Martin officials, however, had faith in their new bomber. On their own initiative they tooled up for big production. Indeed, the first Marauder off the line was no prototype, but a regular production model. And she did things no other bomber could do. Her speed equalled that of fighters . . . her bomb load exceeded that of some heavy bombers . . . and she bore such Martin "firsts" as the all-plastic nose, power gun turrets, self-sealing fuel tanks, heavy armor. True, she was no ship for old ladies to handle . . . but in the hands of the Army Air Force she was 15 tons of flying fury.

From Midway to the Mediterranean

Okay, said critics, but what will she do in actual combat? They found out when the reports from Australia started coming in.

Meanwhile, farther north, the Japs struck at Midway and the Aleutians. Among other unpleasant items, they met Marauders carrying torpedoes . . . the Army's first torpedo bombers. At Midway hits were scored on Jap carriers and cruisers; in the Aleutians, one cruiser was sunk, a carrier damaged. Later, when the steady hammering of Kiska began, two Jap destroyers and numerous supply ships were sunk. The Marauders were hitting their stride . . . and their targets.

That summer General "Jimmy" Doolittle, fresh from Tokyo, dropped in at the Martin plant. A new mission was brewing, he confided, and this time the outfit which bombed Tokyo was going to fly Marauders. Modifications had to be made to suit the climate . . . North Africa, as it turned out later. What Doolittle's air force did in Tunisia, and Sicily, is history. At this writing Marauders are applying the hot foot to the big Italian boot.

"No plane like the B-26"

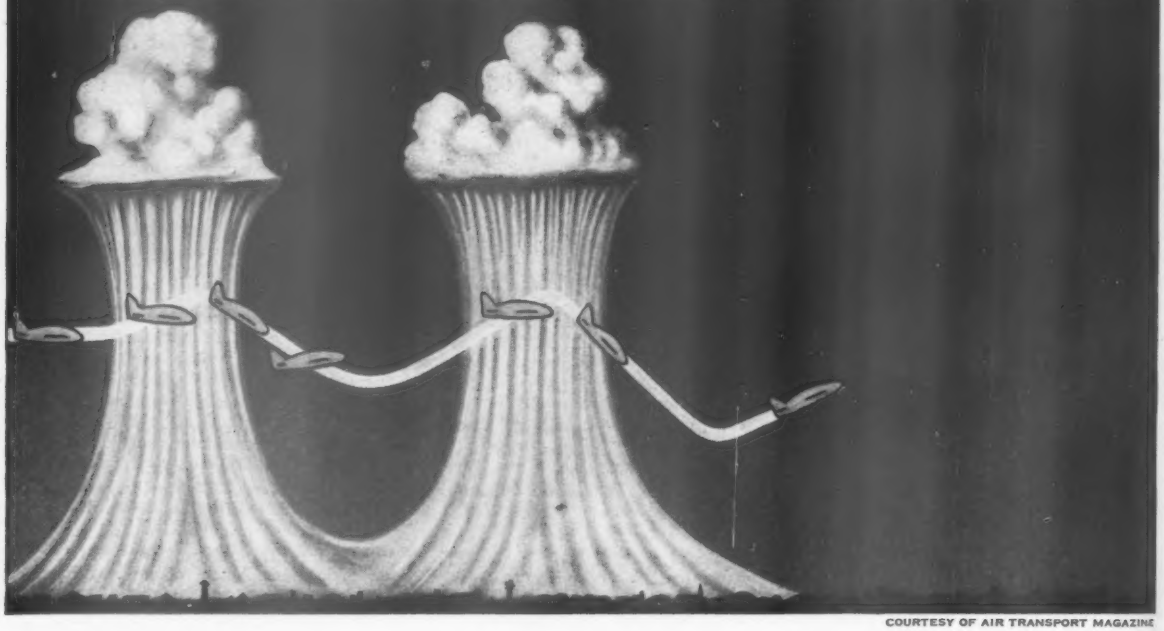
From cloud tops to treetops . . . as medium bombers, torpedo bombers, or long-range fighters . . . from Alaska to New Guinea to the Mediterranean . . . Marauders are taking on all comers. General Arnold, chief of the Army Air Force, has called them "great bombers" . . . OWI dubs them "the most efficient planes in the world in their class" . . . but perhaps the most significant tribute comes from the Air Force men who fly them. As one Marauder ace, veteran of the Southwest Pacific, said quite simply: "There is no plane like the B-26. It can't be beaten in design, sensitivity and control."

Considering the source, no higher praise could be given the Martin Marauder.

The Glenn L. Martin Co., Baltimore, Md., U. S. A.
The Glenn L. Martin-Nebraska Company—Omaha

Evans Skyloader rope hooks and tighteners hold mixed cargo secure in flight. Note the absence of fist-sized knots. A few simple twists of the tighteners make cargo fast or release it for speedy off-loading.

Skyloader metal tie-down rods with locking hardwood beams make odd-shaped or heavy cargo virtually part of the airplane. Skyloader equipment is simple to use, light in weight, eliminates all slack.



COURTESY OF AIR TRANSPORT MAGAZINE

safeguarding air cargo against turbulence

Sharp down- or up-drafts can play havoc with air cargo—tear it loose—cause shock—result in damage! But when air freight is made secure by Evans Skyloader equipment, safety of cargo, plane and personnel is assured. Evans Skyloader method offers a simple, practical system of protecting air cargo against the stresses of turbulent air—a system that is being proved on thousands of flights through all kinds of weather.

Skyloader equipment is of two types: Rope hooks and tighteners for mixed cargo; metal tie-down rods with locking hardwood beams for heavier freight. Simple to use, the Evans equipment cuts on- and off-loading time and greatly reduces the weight of cargo lashings.

Evans engineers will be glad to study your special air freight problems.

★ ★ ★

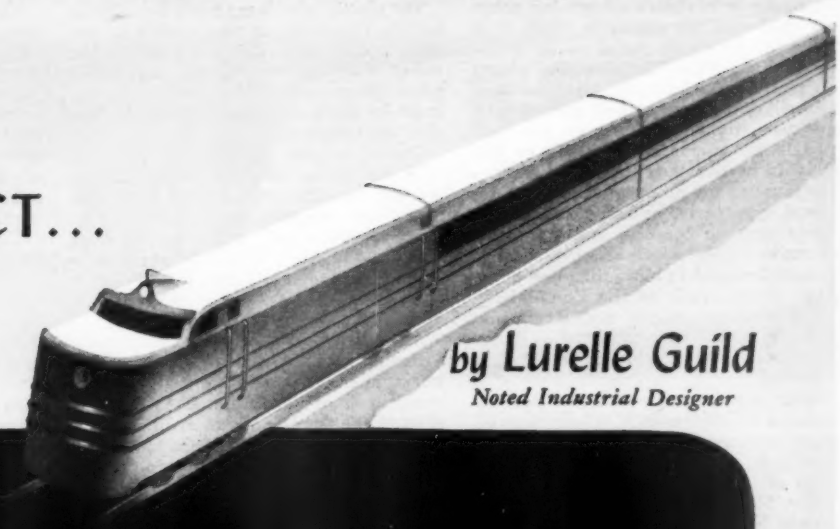
Vision to Anticipate the Needs of Tomorrow
Creates New Industries Today

PRESIDENT

EVANS PRODUCTS COMPANY
DETROIT

Evans War Products: Machine Gun Mounts • Tank and Automotive Heating and Ventilating Equipment • Evanoil Water Heaters • Aircraft Engine Mounts • Airplane Landing Gear Beams • Battery Separators • Prefabricated Houses • Plywood • Skyloader • Utility Loader • Auto Loader • Auto-Railer • Auto-Stop • Stampings

I PREDICT...



by Lurelle Guild

Noted Industrial Designer

The railroad car of tomorrow will make today's de luxe cars resemble the stage coach by comparison. I have designed for one of the country's largest railroads a train embodying numerous new and practical features including super-efficient heating and cooling systems to eliminate dust, germs and draft. Coach passengers will have club car comforts. You'll experience the restful quietness of acoustically-correct, fabric-coated walls; color-corrected, cold cathode lighting with pinpoint lights to spotlight at night the individually reclining seats that will face the windows. Your luggage will be safely secured in individual lockers and all cars will be wired for sound and telephone connections. Yes, your War Bonds will buy you many delightful experiences on the railroad trains of tomorrow.

Note: The Weatherhead Company, exclusive American manufacturer of Ermeto fittings, made vital parts and assemblies for the railroad industry in its four plants prior to Pearl Harbor. We hope to contribute our services and facilities to this important industry again after Victory is ours.

Look Ahead with

Weatherhead

THE WEATHERHEAD COMPANY, CLEVELAND, OHIO
Manufacturers of vital parts for the automotive, aviation, refrigeration and other key industries.

Plants: Cleveland; Columbia City, Ind., Los Angeles
Canada—St. Thomas, Ontario

FREE: *Write on company letterhead for "Seeds Of Industry"—a history of the Weatherhead facilities and products.*

(*Continued from page* 136)

tered is cut off, the parting lines are cleaned, and the whole is sanded. Now the model is complete except for painting. Although the plastic is black, it is shiny and details do not show up or are lost in highlights. Therefore the planes are given a coat of matte black lacquer.

Finally they are packed individually. The more complicated models are fastened to the carton so they will be less likely to be damaged in transit.

Because of size or design complications, several types must be assembled. Large planes such as bombers and transports are made hollow, which requires them to be manufactured in more than one piece. Other planes, such as the Consolidated *Catalinas* have gadgets and struts and must be assembled by hand. Wings and struts are attached after the fuselage is molded.

Other complicated models include the Japanese Kawanishi H-97, a twin-float biplane seaplane with tail float; the Italian Fiat CR-42, a maneuverable biplane with wings of unequal span, and the British Fairey *Swordfish*, the now obsolescent torpedo bomber used in the early part of the war. The *Swordfish* is a biplane with non-retractable landing gear.

"There aren't many American models that need assembly," Mr. Livingston comments. "Our planes are very clean."

The plastic models are being brought up to date constantly as new models or improvements appear. The armed forces notify the Cruver company when this takes place and master model changes must be made and approved before the dies are changed.

Orders for the models come from all over the globe, wherever Allied armies are fighting. It is not unusual to receive a cable or telegram to have so and so many models ready for delivery aboard a plane of the Air Transport Command to be flown to some distant theater. Possibly some over-enthusiastic or forgetful gunners need more lessons in recognition.

An indication of the value the armed forces put upon the model planes is contained in a recent telegram to the Cruver company from Rear Adm. D. C. Ramsay, chief of the Bureau of Aeronautics, U. S. Navy. "Extensive use of recognition devices has proved to be invaluable in developing the fighting efficiency of our Naval forces," Rear Admiral Ramsay stated. "Plastic plane models such as you are making for the Navy are considered so important in our training program that they have been installed on all aircraft carriers as well as in Naval air stations and training commands."

The planes are ordinarily sent in sets, although the sets do not constitute any particular arrangement of models. Though Mr. Livingston refuses to talk prices because the models are not now sold to private individuals, he did suggest that after the war it might be possible to retail sets of model planes for an average price of perhaps $1 per plane. Individual planes might be priced accordingly, though some models would be more costly than others.

The planes are molded in black plastic to meet specifications of the armed forces but they can be painted any color and a number have been prepared in the brownish green of the AAF, with the United States insignia upon them and with scale model propellers added. Each plane has a tiny hole through the center which permits it to be mounted or suspended on its center of gravity. Each also is clearly identified as to country or type. If used by both RAF and United States, that too is indicated.

In addition to certain secret devices, the Cruver company also manufactures aerial dead reckoning computers, true air speed computers and bomb recorder frames. END

Future Air Traffic Control

(*Continued from page* 74)

siderably lower than the present cost of Pullman travel. It might well be argued that with no great difference in safety, with equal convenience, and with roughly equivalent rates, the great time advantage of the airlines will ultimately attract substantially *all first-class long-haul passenger traffic* to air travel.

"As a *generous margin* of *conservatism*, let us assume that within the next decade or two air travel in the United States will assume proportions equivalent to approximately 70 per cent of present-day Pullman rail travel, or about six billion revenue passenger-miles."

The NRPB then makes the forecast that 20,000,000 passengers or about 600,000,000 ton-miles will be transported annually some time between 1950 and 1960.

Mr. Warner, in April, 1943, stated, "The airlines shortly after the war will be performing between five and 10 billion passenger-miles yearly as compared with one and one-half now."

Robert H. Hinckley, former assistant secretary of commerce for air, forecast that 20,000,000 passengers will be transported two years after the war; say, in 1946 or 1947.

Insofar as air traffic control is concerned, the CAA feels that it would be unsafe to plan facilities on less than a traffic of 20,000,000 passengers per annum, by 1950.

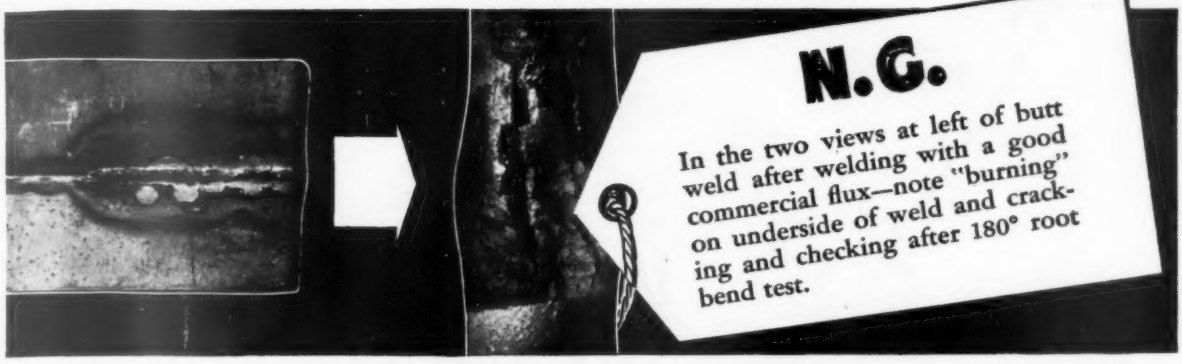
The development of air freight is, beside a question of speed, primarily one of price. The NRPB says on this subject:

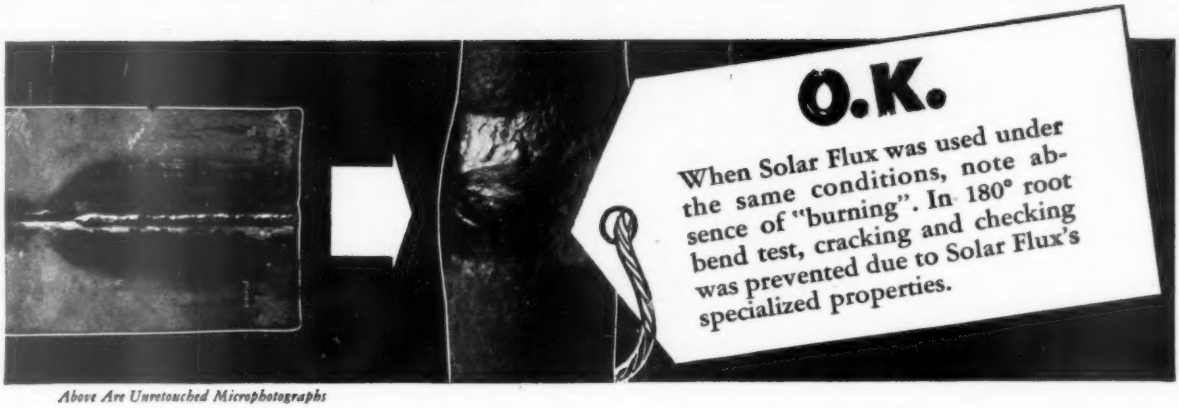
"A plane designed strictly for cargo and mail traffic may be able to increase the per cent of pay load to gross weight very substantially, probably to 35 or 40 per cent. A higher landing speed will be permissible where passengers are no longer involved, which in turn means a larger pay-load capacity. These factors, together with other changes in operation practice, may well result in an ultimate significant operating cost per cargo capacity-ton-mile approaching five or six cents. To this would have to be added, of course, the airline's overhead, equivalent to perhaps two or two and one-half cents per capacity-ton-mile; as well as such pick-up and delivery expenditures as are inherent in handling cargo traffic.

(*Continued on page* 143)

"We'll get a promotion if we intercept him before he reaches the captain's wife!"

WELD BETTER WITH SOLAR FLUX


N.G.
In the two views at left of butt weld after welding with a good commercial flux—note "burning" on underside of weld and cracking and checking after 180° root bend test.


O.K.
When Solar Flux was used under the same conditions, note absence of "burning". In 180° root bend test, cracking and checking was prevented due to Solar Flux's specialized properties.

Above Are Unretouched Microphotographs

For Stainless Steel and Similar Alloys

Solar Flux No. 16GH (Patent Applied for) was developed in Solar's own laboratories, first for the company's own use, meeting the exacting requirements which have given Solar a world-wide reputation for producing stainless steel products of highest quality. Results have been proven on stainless steel and similar alloys in Solar's own plants and by many other new users.

Curtails Rejects

No matter how skilled the welders or how efficient the procedure, flux alone can determine results! Solar Flux prevents "burning" (oxidation) and curtails rejects. No carbon pickup results from flux itself. It promotes metal flow when applied to welding rod and protects rod from oxidation.

Speeds Production!

To speed production, this specialized flux is easy to mix and apply. Needs no shellac. Can be applied days before actual welding. It sticks despite frequent handling. Solar Flux can be used with oxyacetylene, atomic hydrogen arc, metallic arc and heliarc welding processes.

No Toxic Fumes!

Under normal ventilating conditions, welders work comfortably without wearing masks where Solar Flux is on the job. WRITE AT ONCE—A free sample and further details will be sent to any plant engaged in War Production.

ARMY E NAVY

SOLAR

STAINLESS STEEL PRODUCTS

SOLAR AIRCRAFT COMPANY • SAN DIEGO 12, CALIFORNIA

Your ears won't pop

...coming "downstairs" in tomorrow's pressurized cabin

Headaches won't bother you, you won't feel dizzy, no matter how high you fly. For the discomforts due to changes in altitude and air pressure will be eliminated in *AiResearch-pressurized Cabins.*

After the war, AiResearch will have ready the automatic air control device that "seals" low altitude inside the cabin. While the plane takes off . . . lands . . . even while it flies thousands of feet high in the thin, cold air—the altitude *inside* will be constantly measured to your personal comfort.

AiResearch engineers have worked long to bring this new development about. In our giant "Stratolab," they've simulated altitudes higher than man has ever flown, air far thinner than human life can stand—and have found ways to harness these extreme conditions for man's benefit.

Out of this AiResearch work have come many important new developments for American warplanes. Yes, and when peace comes, AiResearch wizards of air control will bring you conveniences you've probably never dreamed about. New comforts for your home, office and farm as well as travel —all bearing the name *AiResearch.*

AiResearch
MANUFACTURING COMPANY
LOS ANGELES • PHOENIX
DIVISION OF THE GARRETT CORPORATION

"Where Controlled Air Does The Job" • Automatic Exit Flap Control Systems • Engine Coolant Systems
Engine Oil Cooling Systems • Engine Air Intercooling Systems • Supercharger Aftercooling Systems

(*Continued from page* 140)

"Applying these data, we find an average possible charge for air freight of 18 cents or less per ton-air-mile. This is roughly *equal* on an equivalent basis, to the present charge for first-class and parcel rail express shipments."

Under these conditions the NRPB estimates that air freight may exceed 600,000,000 ton-miles annually *some time between 1950 and 1960.*

Mr. Warner predicts that cargo will range from 50 to 150 million ton-miles yearly *shortly after the war* as compared with 15 million now.

Such authorities as Grover Loening have predicted, however, that cargo planes of a new type with a gross load of 200,000 pounds and a pay load of 40 tons will bring operating costs down to under four cents a capacity-ton-mile.

Furthermore, air freight will not have to depend on ground transportation. Airplanes can be used for local pick-up and delivery—to and from roofs of office and factory buildings—and direct from a store to a customer's backyard. There undoubtedly will be a system of freight airports, located and designed exclusively for air cargo, separate from passenger airports. In addition, many industrial companies will have their private airports adjacent to their plants. The development of gliders and glider pick-up will make possible practically universal air cargo service through the use of small and cheaply constructed landing areas.

Thus, after the war, huge quantities of cargo will be shipped by air, not only because it is faster and requires no transfers, but also because it will be cheaper.

Under the circumstances, it is felt that air traffic control facilities should be planned for a combined air freight, mail and express traffic of no less than 600,000,000 ton-miles per annum, by 1950.

In 1940, the total air carrier passenger and freight traffic was 97,900,000 ton-miles, according to the NRPB's report. The 14 airway traffic control areas then in existence, and covering only a part of the country, handled some 650,000 air carrier movements. Weighting this figure upward conservatively to obtain an approximation of the air carrier movements which would have been handled had the entire nation with its present 23 airway traffic control areas been subject to airway traffic control, we reach a total of 815,000 aircraft movements corresponding to these 97,900,000 air carrier ton-miles.

The combined passenger and freight traffic in 1950, based on the estimates developed in the preceding paragraphs, should total 1,200,000,000 ton-miles. Using approximately the same relationship of aircraft movements to ton-miles as shown in 1940, the total air carrier movements in 1950 should be approximately 10,000,000.

The ratio of aircraft movements to ton-miles is not expected to change to any great extent, for while freight and passenger capacity of long-haul aircraft will increase it is expected that the short-haul mail, freight and passenger routes of pick-up and feeder lines will be greatly expanded. Therefore, taking all factors into consideration, it is estimated that from eight to 10 million aircraft movements annually will result from scheduled air carrier operations in 1950.

Non-scheduled civilian flying accounts for the greater part of civil aviation activities in the United States. In 1939, while air carriers flew about 83,000,000 miles, less than 14,000 private aircraft flew about 180,000,000 miles or a ratio of more than two to one.

The figure of 14,000 private planes invites a comparison with the number of automobiles registered in the United States, which was about 32,000,000 in 1940—one automobile for every four persons. The ratio of private planes to automobiles was therefore extremely low, about 5/100 of one per cent—less than one plane for 2,000 automobiles—one plane for every 9,000 persons.

After the war, however, with our great aviation factories, our war work experience, mass production methods and extensive research work, the mass production of easy-to-operate private planes, at low cost, is a virtual certainty. The ratio of private planes to automobiles consequently will be less uneven a few years after the war is over. Citing again Mr. Hinckley in this connection, he forecasts that two years after peace returns (1946 or 1947) half a million Americans will be flying their own planes. This would place the ratio of privately-owned planes at only a little over one per cent of automobiles, or one plane for 70 automobiles—one plane for 275 persons.

To this 500,000 private planes should be added many military aircraft in a number difficult to evaluate at the present time but which, even in peacetime, should be well in excess of 10,000 planes and advanced trainers.

Taking various factors into consideration, it would be unsafe, when planning facilities for air traffic control, to figure on less than 500,000 non-scheduled flying planes, both civilian and military, by 1950.

(To be continued in the March issue)

Aviation at West Point

(*Continued from page* 44)

cers who graduated from the Military Academy on June 1, 1943, there were 206 who wore the silver wings of the Army Air Forces. These were the first men to wear wings earned in training received entirely at Stewart Field.

The class now operating in advanced training started that course early in September after completing basic training during July and August. The summer months were spent by the air cadets at Stewart Field in their own squadron area for the first time, saving the time required in transportation between the field and their barracks at West Point.

It was during the July and August basic session that Stewart Field flying instructors and their cadets set a record for flying time. The instructors averaged 112 hours each in the air during July and at least 100 each during August. Thus each cadet under their wing received more than 80 hours of instruction or 10 hours longer than the schedule requires.

Not only flying is taught at Stewart Field. The ground school phase of aviation is also a most important department at this station. During their basic training cadets, between flights, attend classes in instruments, weather, communications, code, navigation and aircraft recognition. In their advanced period, they continue some of these courses as well as taking up Naval recognition, pilots' information file, duties of squadron officers, and armament and gunnery for single-engine students, with bombing for multi-engine cadets.

For the advanced school, the class is divided according to the findings resulting from basic training. Some cadets, considered qualified more for twin-engined piloting, are selected for this school, while others deemed adapted to fighter flying are assigned single-engined planes.

Stewart Field's ground school occupies a large building which includes a spacious main floor area easily subdivided into four classrooms by sliding walls; other accommodations bring the total to seven classrooms, plus offices, storerooms and workrooms for the faculty and personnel. There are also two cadet operations buildings—single-engine at one end of the line near base operations, and twin-engine at the other end of the flight apron and these buildings also supply classroom space.

Succeeding Col. Benjamin J. Webster, second director of training, Lieut. Col. William B. Kieffer now is in charge of the air schooling of cadets with Maj. Thomas S. Torresson Jr. as director of flying. Lieut. Col. Robert M. Kraft is director of ground school, with Capt. Edgar J. Burns as acting director in Colonel Kraft's absence. In command of Group I—twin-engine instruction—is Maj. Kenneth K. Klingensmith. Group II, single engine, is under Maj. Horace N. Crecelius.

The physical layout of Stewart Field is quite ideal for a flying post. Practically isolated from the flight line and runways by natural contours, the station proper is nestled in low areas and on the sides of convenient hills which also serve to conceal buildings and flight line from any public view. Neighboring state highways provide the public only a view of planes landing, taking-off or taxiing, and a distant perspective of the communications tower and base operations.

Behind these natural barriers is a

complete Army Air Forces post, a village of no mean proportions, increasingly pleasant in its atmosphere as hard roads and walks border green lawns around the well-designed Georgian-type brick buildings. In this community are contained in convenient relation to each other a headquarters building, post exchange, commissary, War Department theater, ground school building, post chapel and a consolidated mess building in which most of the enlisted personnel of the field are fed.

The medical detachment is housed in the station hospital, located in its own segregated area where also are located the nurses' quarters, flight surgeon's accommodations, surgery, dental clinic, dispensary, various wards and all appurtenances which make up a thoroughly modern Army hospital. The hospital is under the direction of Maj. Henry Ross, M.C.

Four Link Trainer buildings, a photo laboratory, bombing training and gunnery training buildings are located in the main area. All the working facilities of the field are readily available to the various squadron areas. Enlisted men and WAC's are quartered in brick barracks, each unit operating with an orderly room and supply building as its headquarters. Dayrooms are numerous on the field. Most of these were well equipped by civilian organization of nearby Newburgh.

The flight line flanks one side of this area. Besides hangars, school and base operations buildings, a sub-depot handles supplies and repair work for the airplanes, with warehouses, assembly hangar, offices, machine shop and parachute building.

For the first year of the field's development, airplane maintenance was handled by the various school squadrons, but line facilities have been reorganized to embrace the production line maintenance plan now finding widespread favor throughout the Air Forces.

The enlisted personnel serves under the director of services, Lieut. Col. Charles O. Moody, executive officer. In this respect, too, Stewart Field considers itself remarkable since the enlisted men of the field boast an Army GCT average of 109.1 for a median of about 112—indicating that at least half of the soldiers are theoretically mentally qualified for Officers' Candidate Schools.

Named after Lachlan Stewart, sea captain and Newburgh businessman, the original tract of about 222 acres for Stewart Field was presented through the city of Newburgh by a son, Samuel L. Stewart. This tract, of course, was greatly expanded through War Department purchase of the adjacent farmland.

Located in hilly country, neighboring the famous Highlands of the Hudson, Stewart Field is now considered peculiarly well situated for complete education of flyers since—in contrast to the flat areas of our country more predominantly favored for training—it affords the cadet an opportunity to cope with weather and flight conditions encountered only in such northern climate.

Stewart Field is West Point's answer to this war's—and any future war's—challenge of air power. END

Atlantic Steppingstone

(*Continued from page* 33)

the 2,060-mile hop from Bermuda to Horta and final 1,050-mile run from the Azores to Lisbon. Westbound *Clippers*, when landings are impossible or problematical at Horta, are routed south from Lisbon to Bolama in Africa and thence across to South America.

Construction of a new breakwater at Horta has been suggested but deemed too costly. Flying boat builders and operators held it more practical in the future to go to larger planes which can fly nonstop across the ocean. Such craft probably would have been operating today had it not been for the war.

FLYING

"I built it during my lunch hour!"

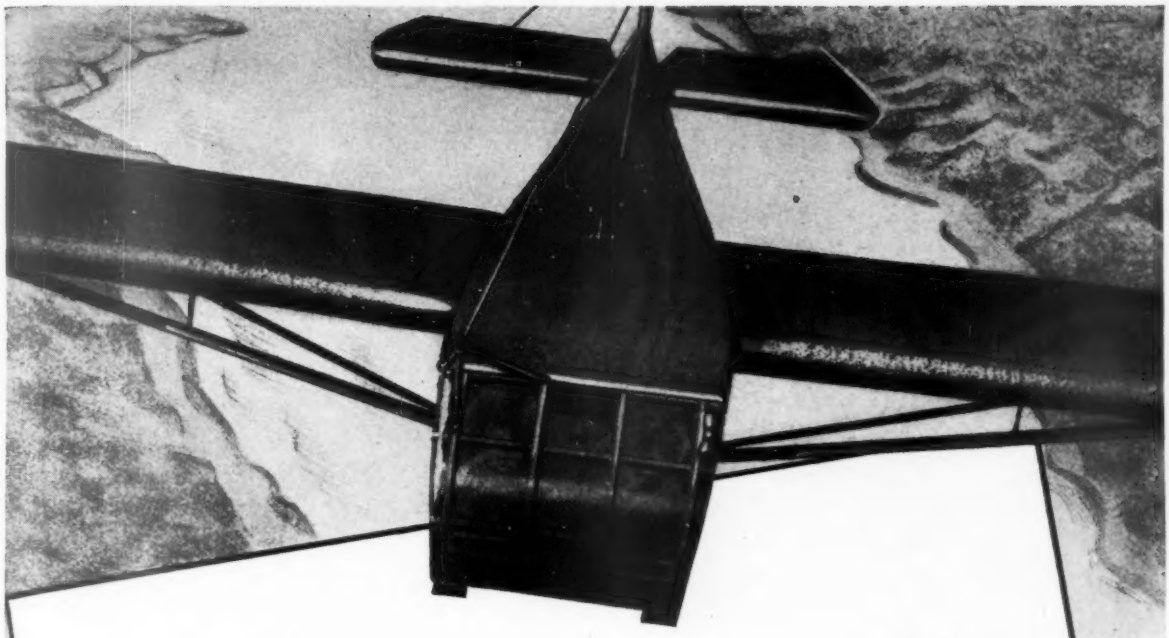
No details were announced regarding Britain's plans for using the bases obtained under their six-centuries-old treaty with Portugal. But if the United Nations are to make full use of the Azores as an anti-submarine base, it seems reasonable to suppose that landing fields and facilities for long-range land-based bombers will be developed. It is no secret that four-engined land-based *Liberators* have replaced *Catalina* flying boats on U-boat patrol to a large extent.

Prior to the war there was nothing like a modern airfield in the islands. But the Azores, though mountainous and of volcanic origin, are no mere rockpiles in the mid-Atlantic. They are self-supporting agriculturally and have some flat area. In the last war, American Marines had an air base in the islands and the British Information Service is authority for the statement that today there is a "good" airfield on the north side of San Miguel Island and two others on Terceira Island at Lagens and Achada.

If airdromes capable of handling *Liberators* now are available in the Azores or are being developed, transatlantic air travel is bound to be affected, both during the war and afterwards.

Much data regarding military air transport routes is secret, but the fact that our land-based bombers and transports hop to England via the Newfoundland-Iceland-Ireland route (often non-stop) and to North Africa by way of Brazil and West Africa is no longer restricted.

(*Continued on page* 148)



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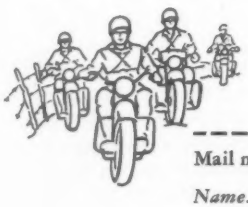

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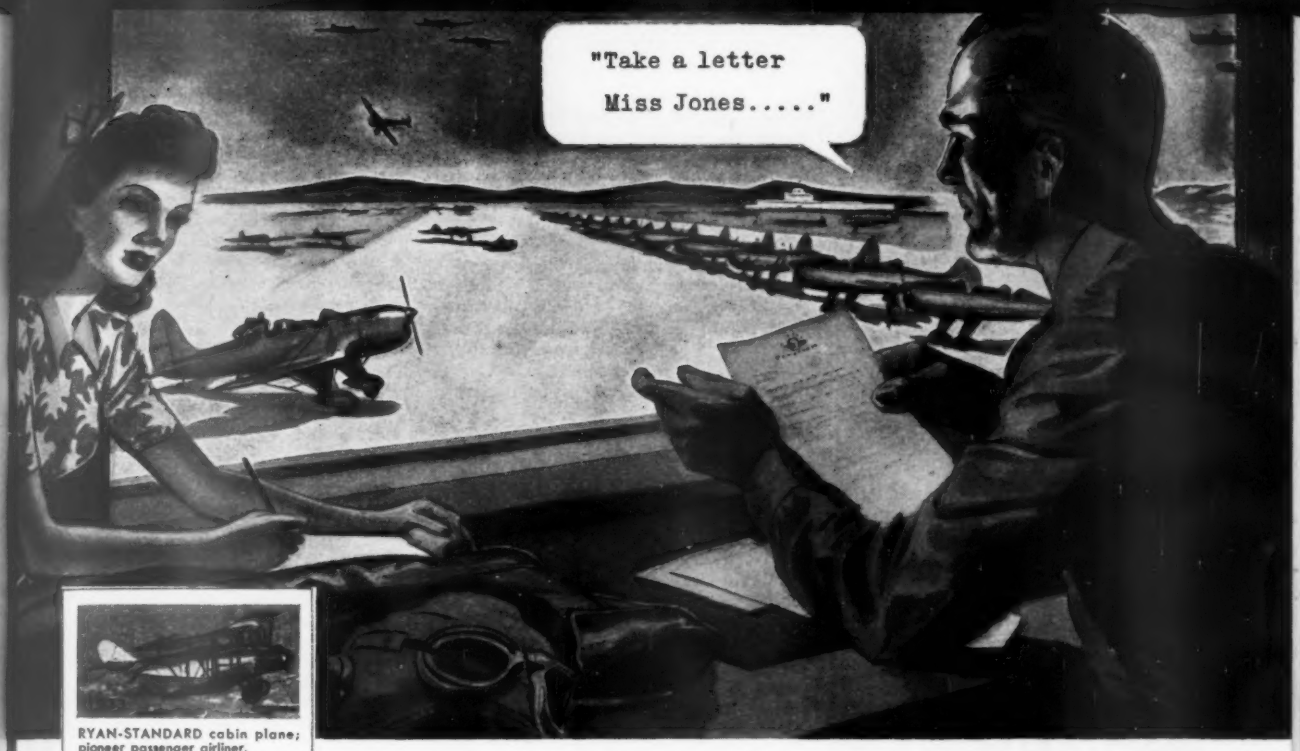

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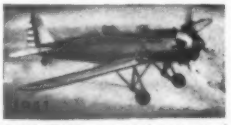

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Another, the head of large scale training operations in Texas, writes: "... they have continued to be the most satisfactory secondary trainer we have ever used.... Their maintenance definitely outstanding.... We have never received better service from any company.... I believe the high quality of our students has been to a large degree directly attributable to their training in these Ryans.... I am keeping one especially for my own use and for pilot checking purposes."

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(*Continued from page* 144)

Therefore, once a base for long-range landplanes exists in the Azores, certain things become obvious to anyone who can use dividers and read a map.

Horta lies 1,750 statute miles southwest of London, 2,422 miles east of New York, and 1,264 miles west of Gibraltar. Our base at Casablanca is about the same distance from the Azores as is Gibraltar.

Thus it becomes obvious that the 7,000-odd miles of the West Indian-Brazil-West Africa air transport route from the United States to our bases in North Africa can be cut in half by operating via the Azores.

The present route to England over the North Atlantic is shorter than by way of the Azores but the latter might make a valuable alternative way to Britain. Moreover, there might be advantages in routing British air traffic from England to North Africa by the way of the Azores rather than by skirting neutral or occupied territory as in the past.

Of course, the southern route to North Africa is now well established. It also has the advantage of more favorable weather and shorter overwater hops, with consequential greater pay load and safety, than going by way of the Azores. These considerations may be a prime factor against establishing any regular new war-time service there.

As to post-war aviation, Portugal's grant of air base rights in the islands to Britain has considerable potential importance. The agreement is for the duration of hostilities only, but whatever improvements the British make to the Azores, land based air facilities almost certainly will be in existence at the close of hostilities. They would, therefore, be available for post-war civil aviation use and would be put into operation if the Portuguese government could lease or operate them profitably.

It is certain that they will be so used. At least until tomorrow's or day-after-tomorrow's super transport planes are designed and built, the Azores seem destined to play an important part in transatlantic air transport.

The British recently announced that they are working on designs for a 130-ton post-war air transport—three times as big as today's *Clippers*—which could carry 150 passengers non-stop on 15-hour flights across the Atlantic. No similar announcement has come from official American sources but undoubtedly our big plane builders are at least as far along on the problem as the English.

Such planes, however, cannot be built until sometime after the war—unless we turn some of our aircraft production facilities to work on them after Hitler is beaten and we are still fighting Japan.

Even so, and perhaps for many years after our new "dream-ships" are operating, the Azores still will have a place as an aerial steppingstone in the opinion of many leading airmen.

Gas load still will have to be balanced against passenger and freight load. Fuel still will weigh about six pounds per gallon, making each passenger and his baggage the equivalent of about 35 gallons of gasoline. And the distance between the Azores and the coast of Europe still will be 1,000 miles. Big planes today get about one mile per gallon, all of which figures out to mean that about 30 fewer passengers can be carried non-stop across the Atlantic to Lisbon than by using the Azores.

Of course, many air transport authorities hold that the quicker, non-stop Atlantic flight will have a greater appeal to the "class" passengers who will make up the bulk of the traffic on the cross-ocean run and, therefore, would outsell the cheaper, broken-flight routes, despite its necessarily higher rates.

Government regulation based on mail subsidies or other controls may play a part here. Moreover, as transatlantic air traffic grows in future years, other routes and varying rates may develop. The Azores lie, it should be noted, on the most direct route between the middle and south Atlantic states, Central America and the West Indies and southern Europe and North Africa.

Mount Pico, the 7,000-foot peak which has been the first sight of the Azores, undoubtedly will continue as a landmark to transatlantic air passengers. END

Dam Busters

(*Continued from page* 66)

other under the tail—at such an angle that their beams would converge at exactly 50 feet below the plane. It was tried. It worked. It was adopted.

The crews did practice-bombing of dams in Scotland and Wales. They scraped up a few bellies on trees and smacked the water a couple of times but the tough *Lancasters* could take it and they did not lose a plane during their rigorous training period. There were 750 men in the squadron of whom 140 were flying personnel. Finally they were ready.

"We started out in conventional V-formation," Wing Commander Gibson related. "Nineteen planes. Our intelligence reports were so accurate that nearly every one of the many hidden gun emplacements along our course had been spotted. Our course turned and twisted to right and left to escape the antiaircraft and many times bursts of flak were thrown up just after we had passed a turning point. Two planes were damaged while crossing the coast and a third hit the water and had two motors ripped off. All three had to turn back but reached the base safely."

Six planes were sent separately to the Sorpe dam for a diversionary attack. They were to put on running lights, drop Verey flares and mines and generally attempt to distract night fighters in the district. Two of these planes were shot down and two more were damaged and had to leave for home.

Led by Gibson the main force of 10 remaining *Lancasters* proceeded to the main target, the Moehne dam. "We had

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studied the maps until we knew the targets by heart," Gibson said. "But when we did arrive over the targets it was much more flat than we had expected.

"Once we reached the first target we split up and it was every man for himself until he was ordered in for his attack. We operated under a strict system of control and had practiced our low-level flying so that our planes could circle out of sight, low over the hills and forests, in order that the German night fighters couldn't find us. We didn't lose a single plane to fighters.

"There was no longer any need for radio silence and I made the first reconnaissance, keeping in telephonic communication with the other planes at all times. The Huns had antiaircraft mounted on the dams but it was not as heavy as over many of the Ruhr cities. They knew the only way we could attack the dams was by a low-level approach and they had their guns set up for just that kind of an attack. They didn't touch me as I came in—in fact I didn't get hit during the entire trip, another great piece of luck.

"After my attack I had to wait about 15 minutes because of the huge splashes and terrific waves on the lake—it was like a tidal wave. Finally the water quieted down and I went in for a reconnaissance, shooting at the German gunners as I passed. Meanwhile the German planes were all over the sky trying to find us.

"After my reconnaissance I ordered the next plane in. John Hopgood was pilot. 'Hoppy,' we called him. He was shot down by the light flak while he was making his attack.

"And so it went. I would order the planes in one at a time and make a reconnaissance after each attack. They were circling around out of sight but never far away. They would come in low over the moonlit water, only 50 feet high, and drop their mines. Then, if they were lucky, they would make their escape flying low. Finally I observed that the dam was breached. There seemed to be a break about 100 yards long and a 150-foot wall of water was pouring out of the break."

Throughout the attack Gibson kept flying back and forth over the target continually, picking off the guns and gunners and diverting some of the defensive fire to himself.

"All this had taken about an hour and a half and what was left of us rendezvoused over the east end of the reservoir and went on to the Eder reservoir, repeating our attacks there by the same method."

It was late when they arrived. Gibson had no mines left and the attack was made by two Australian boys. Each made dummy runs over the target before dropping his load and the others kept up a constant ribbing over the radio telephone. "You were taught better than that, Lad." "Been doing it better than that for weeks."

Gibson continued: "We were over the targets for about two hours and a half. The suspense was terrific. You would go in for a reconnaissance. Then you would order another man in. Often you would see him go in and see him blown up. And then it would be up to you to tell the next chap, 'Well, it's your turn to go in and get blown up.'

"You'd be talking to him, and then he'd be gone. Meanwhile, all the other chaps would be circling out of sight waiting for their turn."

After the Eder dam was breached each plane lit out for home—each except Gibson's, that is. It was his duty to return to the Moehne dam to assess the damage, for if demolition were not complete the planes were to return again before dark. When he arrived Gibson found the reservoir already two-thirds empty. Old foundations of houses and bridges that had spanned the river long before were now visible for the first time in years.

Within 18 hours, reconnaissance reported, the reservoir was down to a little creek in the middle of the valley. Later it was learned that water from the Eder had raced through the streets of Kassel, flooded buildings and factories. Delicate precision machinery was damaged or ruined by silt, mud and rust. The waters from the Eder dam flooded the underground hangars and best-equipped German officers' mess in the country at Kassel airdrome.

Fifty-six men, including two wing commanders, were in the eight planes which failed to return. For his exploit in leading the men, and for his conspicuous gallantry beyond the call of duty, Wing Commander Gibson was awarded the Victoria Cross. Previously he had been twice awarded the Distinguished Service Order for daylight raids on Italy and elsewhere and twice, as a fighter pilot, the Distinguished Flying Cross for shooting down seven German planes.

General Arnold personally pinned the American Legion of Merit (degree of commander) ribbon on him with the following citation:

"Wing Commander Guy Penrose Gibson, RAF, commanded a special organized air force squadron which accomplished the destruction of the Moehne and Eder dams, flooding large areas of enemy territory, with serious impairment of the enemy's productive capacity.

"Wing Commander Gibson personally led the formation attacking the Moehne dam. At extremely low altitude, and in the face of severe antiaircraft fire, he pressed home the attack, and then deliberately circled over the objective for 30 minutes to draw the enemy fire onto himself, and facilitate approach to the target by the remaining planes of his squadron.

"After completing the destruction of the Moehne dam, Wing Commander Gibson led his squadron to the Eder dam, and using similar tactics, completed the destruction of that objective.

"During the entire operation Wing Commander Gibson demonstrated the highest type of leadership, and completely subordinated regard for his own safety to the successful accomplishment of his mission. His outstanding service and leadership is an inspiring example to the armed forces of the Allied nations, to whose cause he has made a material contribution." END

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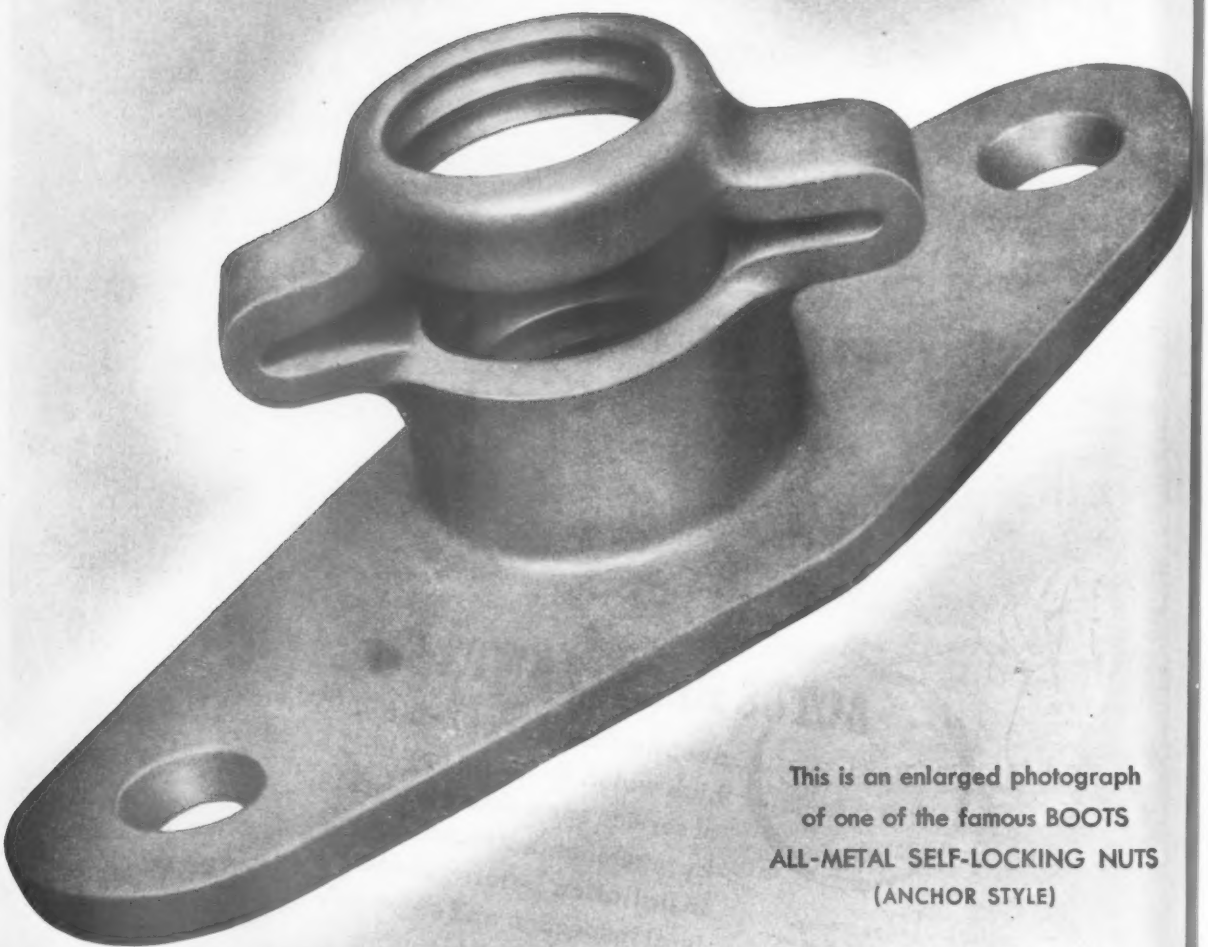

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All-American Air Team

(*Continued from page 24*)

scholarships is that candidates have a sponsor "willing and able to employ them in the field of aviation on their return to their native country after successfully completing the training."

Prospective pilots will receive their training at Purdue University, while the instruction center for aviation mechanics is Springfield, Mass., Trade School, with nearby American International College housing the students and providing courses in the English language.

The training period is one year. Mechanics get 2,000 instruction hours, covering the requirements for the CAA mechanic certificate with an aircraft and aircraft engine rating. The pilots-to-be take the CAA War Training Service elementary, secondary, cross-country, instructor, and Link instrument courses, at the end of which they should be qualified for a CAA commercial pilot certificate with instructor and instrument ratings.

The pilot and mechanic scholarship winners must be between 21 and 28 inclusive; have a working knowledge of English or a marked ability for learning it, as evidenced by an aptitude test; six years of schooling in the case of mechanics and a secondary school education for prospective pilots.

The U. S. Government will pay the cost of tuition for all trainees, their room and board, a $30 a month cash allowance for incidental expenses, and transportation from the candidates' homes to the training center and return. Students are cautioned, however, that because of the emergency transportation situation they may not bring wives or dependents, and must agree not to acquire dependents while in training here. The latter stipulation is traceable to the fact that some of the first group of trainees married while here, and because they couldn't arrange transportation to their home countries for their new wives, stayed on in the United States.

In addition to 31 pilot and 70 mechanic trainees, the CAA will train during the coming year a group of 18 technicians in specialized fields to be designated by their governments. Airport construction, air traffic control, and communication systems are among the branches of aeronautics which might be studied. Technicians may range in age up to and including 30.

Companion benefit to the production of American personnel for hemisphere aviation has been the promotion of mutual understanding between the people of the two Americas. The hundreds of young men who have gone back to their own countries after six months to a year of close association with the instructors and students of the U. S. schools have got the "feel" of our way of living, and in turn have imparted to many U.S. communities a true picture of life below the Rio Grande.

Typical of this interplay, though on the lighter side, was the reply of Ricardo Borda, trainee from Iquitos, Peru, at White Bear Lake, Minn., (a center in the first program) when a U.S. student there offered to teach him poker: "Fine, we'll be glad any time to trade rhumba lessons for poker."

Regardless of their backgrounds, the Inter-American trainees have taken readily to the democratic customs of the United States. Jaime Lauro Siciliano Smith de Vasconcellos of Brazil became Jimmy Smith about three hours after he arrived at the training center, and after six more hours he was used to it and proud of it, despite the fact that he is an admiral's nephew in his home country.

Such adaptability would be expected of youth, but it was also shown by the more mature Senhora Anesia Pinheiro Machado. Senhora Machado, leading woman flyer of Brazil, and wife of a high officer in the Brazilian air force, learned to like the appellation of "Shorty," pinned on her by personnel of the CAA's standardization center at Houston, Tex. As the guest of the CAA, she took advanced courses there qualifying her for instrument and instructor ratings, with the idea that she would observe U.S. instruction methods and utilize them in her native Brazil.

One other facet of the CAA's Inter-American activity is the sending of specialists to help standardize systems of inspection and examination. CAA Inspector C. J. Tippett is now in Brazil

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advising that country how it can adapt methods successfully tested over a 17-year period by air safety personnel of the CAA and its predecessor U.S. agencies.

Asked to sum up the present status of the Inter-American program, officials of the CAA and State Department say: "We believe that the program is on a thoroughly practical basis, designed to make good neighbors as only aviation can with its ability to shrivel distances. In requiring that each applicant have a sponsor willing and able to employ him in aviation upon completion of training, we have strong assurance that funds expended in training these boys will pay dividends in real accomplishment and friendship. While we are well satisfied with the results of the first courses, we expect that the new program will produce an unmatched group of earnest and capable young men equipped for aviation in the Americas." END

Butane for Aircraft

(*Continued from page* 46)

the design of a butane-powered engine and would go a long way towards solving some of the present high altitude cooling difficulties. Where additional cooling is desired, part of the fuel could be recycled back into the tank as a liquid and any amount of desired cooling could thus be obtained. Because of the available altitude-cold for condensing purposes this would be an easy cycle to accomplish as very little pressure would be necessary on the re-cycled vapor and a Root-type blower probably could be used for the purpose.

Use of these liquefied gases as a fuel also gives a new approach to the two-cycle type of engine—still the most efficient type considering power output and simplicity.

In theory the two-cycle engine will develop twice the power of a four-cycle type because it fires all cylinders on every revolution of the crankshaft (the four-cycle type firing all cylinders every two revolutions of the crankshaft). Add to the two-cycle type the advantage of the higher compression ratios possible with butane fuel and the potential power output rises to really important percentages over the four-cycle type.

The advantage of this dry vapor fuel for two-cycle work is obvious, primarily by eliminating the old problem of lubricating oil dilution and wash-off from the moving parts within the crankcase which is prevalent with the gasoline fuel formerly used. This was one of the main difficulties of earlier two-cycle types. The dry vapor of butane would also simplify distribution to the cylinders, particularly if it were compressed in the crankcase and allowed to expand within the manifolds leading to the cylinders.

No engine designed to take specific advantage of liquefied petroleum gas fuels has yet been built. Such an engine, using high compression ratios made possible with these fuels, will run from 10 to 15 per cent cooler than the conventional gasoline-fueled engine. It should be possible to achieve an efficiency practically double that of the present engines through conversion of at least 40 per cent of the fuel heat into energy (horsepower), leaving comparatively little heat to be dissipated by the cooling system.

Some of the main features of such an engine, showing how the cold produced by vaporizing large amounts of liquid butane can be used to refrigerate the cylinder cooling air, are illustrated in the accompanying drawing. Note that what we term the cooling coils are also vaporizing units in effect, and supply the necessary heat to vaporize the butane under all conditions. The air is conducted around these coils and pre-cooled through radiation before being drawn past the cylinder fins by the blower of the engine.

The blower in turn delivers the air to the mixing valve under supercharging pressure, where it is mixed with the dry gas piped from the outlet end of the cooling coils. There is no objection to making the blower somewhat larger in capacity, if necessary, as the excess air could be by-passed ahead of the mixing valve at idling speeds. The engine shown is of the "pancake" type capable of being housed within the wing of a plane. A similar utilization of the cold produced by vaporization can also be used to cool, or aid in cooling, engines of the liquid-cooled type by using suitable heat-exchanging methods.

Stepping up the octane rating of gasoline by blending in butane and/or other liquefied petroleum gases and then storing such gasoline in a vented tank is like trying to hold water in a sieve. Such a "hopped up" gasoline may have a 100 octane rating at the refinery but subsequent handling will greatly lower its rating. Storage in a vented tank at the retail point for any period of time, however short, will bring the octane rating down to its normal gasoline content rating of approximately 80, and further weathering of the fuel will take place after it is placed in the vehicle or aircraft tank.

In view of these facts, butane with its normal 100 octane rating is thus the logical fuel for use even though it involves stronger containers. And as pointed out, these can be of a lighter weight construction than has heretofore been considered possible.

In view of the many advantages and potential developments made possible through the use of these fuels for aircraft and other applications where high power output with light engine weight is the main consideration, the author urges that more consideration be given to this subject in future designs. END

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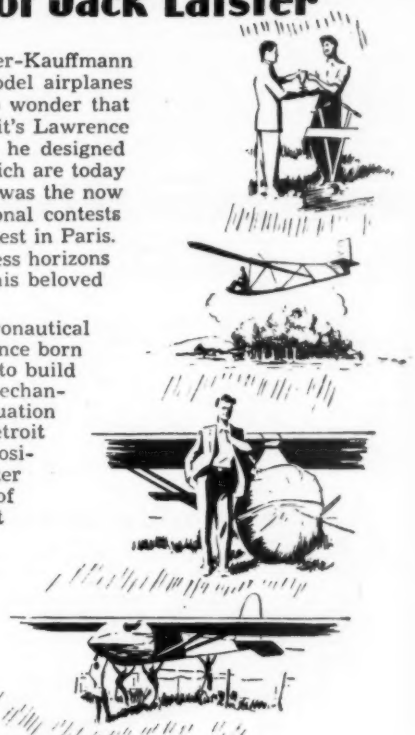
Highlights from LAISTER-KAUFFMANN

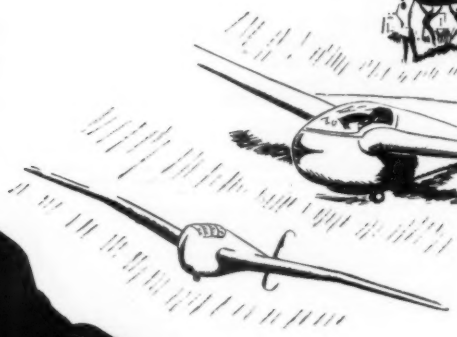
the story of Jack Laister



No desk-born executive is Jack Laister, President of Laister-Kauffmann Aircraft Corporation. At 13 building National prize winning model airplanes ... at 14 his first glider and at 15 making his first flight, it is no wonder that a few years later Jack Laister was earning his tuition at Detroit's Lawrence Institute of Technology as the school's gliding instructor. Here he designed and supervised the building of experimental gliders—two of which are today in use by the Army for glider pilot training. Star of this group was the now famous Yankee Doodle, veteran of numberless State and National contests and high honor contender at the 1939 International Soaring Contest in Paris. In the heart of many a boy now serving his country on the endless horizons of aerial warfare there is a special place for Jack Laister and his beloved Yankee Doodle...

Thus, in 1938, when Jack Laister was graduated as an Aeronautical Engineer, he could approach the business world with the confidence born of achievement seldom seen in a youngster of 24. He continued to build gliders during high school days, and while in college served as a mechanic in a Detroit experimental laboratory; by the day of his graduation he held the position of Assistant Chief Engineer in another Detroit organization. Therefore, it was no surprise when a responsible position with an aircraft manufacturer took 25-year-old Jack Laister to California. And when, two years later, he accepted a job of still more importance in the Middle West, friends agreed that it was *just what they had expected of him!*

Finally, when gliders assumed their present tactical importance in the war, it seemed almost a foregone conclusion that Jack Laister would build them for our government.



Jack Laister's desk is big . . . big enough to serve as a designing board . . . big enough to spread a half dozen blue prints on . . . big enough to take care of the job into which he's putting the last measure of his intelligence, his experience and his devotion—Laister-Kauffmann's war contract—Gliders for the Army—Gliders for the ATTACK!

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Wings FOR THE FUTURE

Laister-Kauffmann *Aircraft Corporation*

ST. LOUIS (17) MISSOURI

(*Continued from page 94*)

The reason the British have just been shoved out of the Aegean islands they captured at the time Italy surrendered is exactly the same—insufficient ground troops to carry on a campaign in Italy and at the same time make a real offensive in the Aegean islands. Their aviation alone, without a sufficient force of ground troops, could not do it.

The result is that because of a lack of sufficient ground troops, our aviation today, instead of being where it could have been had we held the positions occupied in 1939, can only reach Europe by flying across the North Sea and the English Channel from Britain, across the eastern Mediterranean from the Near East and Africa, or from the relatively small part of Italy we hold.

From the beginning of the war to date, except in the case of the combats on the Russian front, the United Nations, when not completely defeated, have only gained relatively small victories after considerable lapses of time.

Poland, Norway, Holland, France, Yugoslavia, and Greece including Crete, were all decisive defeats due to these things: overwhelming German strength on the ground, in artillery, infantry and tanks, overwhelming German strength in the air, and the use of both the ground and the air as a combined whole under a unified command to strike a blow at the enemy's armed forces.

From 1939, until the victory at Alamein something over a year ago, the campaign in North Africa consisted of relatively small British and Axis forces driving each other back and forth. It was only when the British planned the tactics for the Alamein attack that a decisive victory was had.

For this battle the hitherto-prevalent ideas of the plane-tank team, with the infantry and artillery playing a minor role, were abandoned.

Aviation played its part as a strategical and tactical air force tied in to the main attack which began with a heavy artillery barrage and was primarily an infantry assault supported by tanks. Then, when a hole had been broken in the enemy's line, the British armored forces attacked.

This excellent example of the combined use of all arms on the ground with the air above for the purpose of destroying the enemy's armed forces was decisive.

From then on the Axis had really lost North Africa. What followed was merely the pursuit of a beaten force which was insufficiently reinforced and supplied and finally was cornered with its back to the sea and forced to surrender.

There can be no doubt that after the Alamein defeat the strategical use of the air force to cut off its supply and reinforcement from Italy played an important part in the surrender of the Axis remnants.

While all the facts are not yet available for publication, and while our air force has to overcome tremendous logistical difficulties in setting itself up in North Africa, there is a question yet to be answered.

It is: Had the maximum air force available been used tactically to hasten the advance of the troops in Tunis, could not the Axis forces there have been destroyed before the retreating remnants of Rommel's troops could have reached the Mareth Line in southern Tunisia? From the time we landed in North Africa early in November of 1942, it was four months before Rommel's retreating remnants reached the Mareth Line in southern Tunisia.

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flexibility of aviation to produce the maximum fire against the most vital obstacles to the advance of ground troops has and still is dragging out the war.

In the beginning, the loss of time which has resulted could be blamed on the failure of France, Britain and the United States to be prepared for war.

However, at present, with the tremendous air forces available, the failure to move more quickly cannot be blamed on lack of preparedness.

This failure to move more quickly has given the enemy the time to retreat in Russia, to restore his position in the Balkans so greatly weakened by the Italian surrender, and to prepare a number of strong defensive positions in Italy.

Leaving aside the question of whether, in the final stages, the Germans and Italians could have been eliminated from North Africa more quickly, the following should be noted:

1. It took 38 days to conquer Sicily.
2. Most of the German troops with their materiel had time to retreat successfully across Messina Strait to fight us again in Italy.
3. It took 20-odd days to go the 20-odd miles from Salerno to Naples, thus giving the Germans ample time to badly damage or destroy port and other installations.
4. The German troops facing the British Eighth Army were not cut off by our Salerno landing but instead were given time to retreat successfully to the north.
5. Two months after entering Naples we were only 50 miles north of the city.

There is no question involved in all this of the gallantry and courage of the personnel in both the aviation and ground forces. The records show that they did the duty assigned them and displayed courage, endurance and determination, in numerous cases far above that called for in line of duty.

The question being discussed here is not a question of ground troops versus air troops. It is purely one of different theories of strategy and tactics. Neither in Africa nor in Sicily have we had to meet any such combined air and ground attacks as have been habitual on the Russian front for two years. Neither have we so far had to meet such attacks in Italy.

It is very dangerous for us to decide that the air policy which has obtained in Africa, Sicily and Italy will be adequate to meet such attacks as we must inevitably face.

At present we have 11 divisions facing nine German divisions on the fighting line in Italy. We have plenty of divisions in North Africa available for reinforcement, but they have to come across by sea. The Germans have at least 15 more divisions in North Italy. German air forces superior to the ones we have in Italy and North Africa are within easy reach to support the German divisions in Italy.

Suppose, when we have advanced to where the Germans really want to fight, they use their 24 or 25 divisions now in Italy, supported by their air forces within easy reach in Europe, which are far superior to those we have available for the Italian campaign. What will our forces have to face? END

Letters

TRIBUTE

Sirs:

Have just finished reading the December issue of FLYING and come across the story, "Night Raid," by Lieut. (j.g.) Ernie Weyle. When I finished the story I came darn near crying . . .

I was the last person to see Ernie alive. It was one of those overcast dreary days. Ernie was flying a Vultee *Valiant* trainer with me as his right wing man. Breaking in and out of the overcast made formation flying difficult so our instructor motioned us to peel off from the altitude we were flying to a lower altitude.

During this whole flight Ernie and I had been joking back and forth with one another . . . After peeling off, I remember seeing Ernie and the instructor ahead chasing tails in a mild way, waiting for me to catch up. I lost track of one plane and then saw Ernie in the distance in what seemed to be a stall.

As I approached he began to spin. I followed him down, thinking he was using evasion tactics, but at an altitude of 2,200 feet I picked up the mike and told

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Ernie to pull out. At 1,200 feet he was still spinning. Then I began to scream into the mike for him to pull out. Diving as close to the spinning trainer as I dared, I saw Ernie slumped over the side of the plane. The plane crashed in a field of brush and exploded . . .

I circled the burning plane for some 20 minutes . . . unable to help. I personally would like you to know that a grander person never lived.

It seems a shame that out of as many scrapes as Ernie had been in with the enemy he had to get killed in a trainer. "Train Ernie to fly" is a laugh. You might just as well have started training a fish to swim. He fought our enemy long before we entered the war and then came over to our side to add his bit.

ENS. JOSEPH N. CLISE
Instrument Flight Instructors School, U. S. Naval Air Station
Atlanta, Ga.

ORDNANCE JOB

Sirs:

In your October issue, page 146, you pictured an ammunition worker of the Ordnance Department fusing a demolition bomb. You called this man an armorer. The ammunition is ordnance and the man doing the fusing is without doubt an ordnance man. The only duty of the armorer is guns, and armorers in the AAF load bombs into the planes. Inspection, maintenance and delivery of complete rounds to the air force is definitely an ordnance job.

T/SGT. I. H. WADE
859th Bombing Squadron (H)
Blythe Field, Calif.

ANTICLIMAX

Sirs:

A lot of friends of Lieut. Col. C. B. Allen of the Air Transport Command wondered why they didn't see him on his recent leave in the United States. The reason is one of those fantastic things. After establishing a record for the safe operation of ATC lines in Africa with his former colleague of CAA's Air Safety Board, Col. Tom Hardin (see FLYING for December), C.B. and Mrs. Allen were in an interurban bus that overturned.

C.B. escaped injury but Mrs. Allen suffered a painfully wrenched back and C.B. spent most of his leave visiting her in the hospital.

JOHN STUART
Washington Editor
FLYING

WAS THE ZERO SEEN?

Sirs:

You state in the story "Flight-Testing the Zero" in the December issue of FLYING, that the Zero was not reported by spotters on its coast-to-coast flight. It undoubtedly was, but not as the "Zero." The only information required is the number of planes, number of engines, height, direction, etc. Thus, if the Zero were seen, it would have been reported as a single-engined plane.

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Air Power Control

(*Continued from page 48*)

ment of and to destroy hostile bases, (c) to operate against hostile land or sea forces, (d) to wage offensive warfare against the military and economic strength of the enemy, (e) to operate as part of the task forces in the conduct of military operations, and (f) to operate in conjunction with or in lieu of Naval forces.

The regulations contemplate that "counter air force operations in the theater must be carried on *continuously* and intensively to gain and maintain air supremacy and to provide security from hostile air operations," because total destruction of the enemy's aviation is "seldom practicable."

They state that "experience in combat theaters has proved the requirement for centralized control, by the air commander, of reconnaissance aviation as well as other types of aviation. The attachment of a reconnaissance unit to the corps or smaller ground unit would deprive that reconnaissance unit of essential operating information and fighter protection which are readily available to the air commander only. This centralized control improves operating efficiency of reconnaissance aviation and limits reconnaissance losses."

The regulations further hold the Army Air Forces "responsible for providing the reconnaissance and photographic missions essential to the success of the ground forces in each theater of operations. The absence of reconnaissance units specially trained and equipped for the performance of such missions does not alter this responsibility."

The organization and duties of the four main components of an air force—the strategic air force, tactical air force, air defense command and air service command—are described.

Strategic air force operations are aimed at the defeat of the enemy nation. They are undertaken in furtherance of the strategic plans prepared by the War Department general staff. The selection of strategic operations is the responsibility of the theater commander who will ordinarily assign a broad general mission to the air force commander. The latter executes the assignment by means of a directive to the strategic air force commander and general supervision of his forces.

The strategic air force *may also be joined with the tactical air force and assigned tactical air force objectives.*

The strategic air force normally consists of heavy bombardment, fighter and photographic aviation. "Heavy bombardment aviation is the backbone of the strategic air force." Accompanying fighter aviation, where its radius of action permits, is also used to increase security. Fighter aviation furnishes air defense for bombardment bases.

Where ground forces are operating, most theaters of operations have a *tactical air force.* "Modern battle strategy and tactics," declares the manual, "derive success to the degree that air power, sustained and in mass, is employed properly by the theater or task force commander.

"The decision to launch a combined operation and to wage subsequent offensives is strongly influenced by the quantity and quality of air strength available.

"Forces must be developed and committed to battle with overwhelming air components opposing estimated enemy air capabilities."

The manual continues: "In modern battle operations, the fighting of land elements and the general air effort in the theater must be closely co-ordinated. The air battle should be won first whenever other considerations permit."

Tactical air forces may contain reconnaissance aviation, light and medium bombardment units, fighter aviation and an aircraft warning service. "This force does not serve the ground forces only; it serves the theater. Aviation units must not be parceled out as the advantage of massed air action and flexibility will be lost.

"In a particularly opportune situation (offensive) or a critical situation (defensive), a part or a whole of the strategic air force may be diverted to tactical air force missions."

The tactical air force gives first priority of operations to gaining air superiority, second priority to preventing the movement of enemy troops into the theater of operations or within the theater, and third priority to direct support of the ground troops. Some authorities believe that the latter should be given first, or at worst second, priority. This view is supported, for example, by Brig. Gen. Henry J. Reilly in his article "The Misuse of Air Power" on page 21 of this issue of FLYING.

In explanation of its priority assignments, the manual continues:

First Priority. "The primary aim of the tactical air force is to obtain and maintain air superiority in the theater. The first prerequisite for the attainment of air supremacy is the establishment of a fighter defense and offense, including radio direction finder and ground control interception and other types of radar equipment essential for the detection of enemy aircraft and control of our own.

"While our air superiority is maintained, both the ground forces and the air force can fight the battle with little interference by the enemy air. Without this air superiority, the initiative passes to the enemy.

"Air superiority is best obtained by the attack on hostile airdromes, the destruction of aircraft at rest, and by fighter action in the air. This is much more effective than any attempt to furnish an umbrella of fighter aviation over our own troops. At most, an air umbrella is prohibitively expensive and could be provided only over a small area for a brief period of time."

Second priority. "The disruption of hostile lines of communication (and at times lines of signal communication) the destruction of supply dumps, installations, and the attack on hostile troop

(*Continued on page 167*)

"Cat" landing on AEROLS*

Affectionately known as the "Cat," Consolidated Vultee's amphibian airplane, which is named the Catalina, is in the news almost constantly on both our eastern and western battle fronts.

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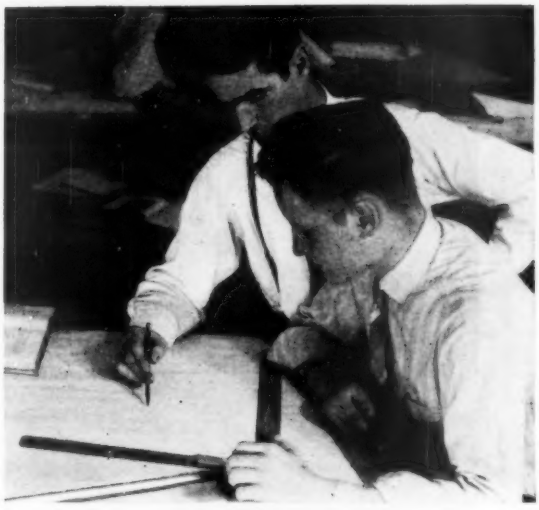

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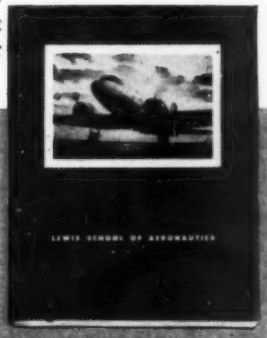

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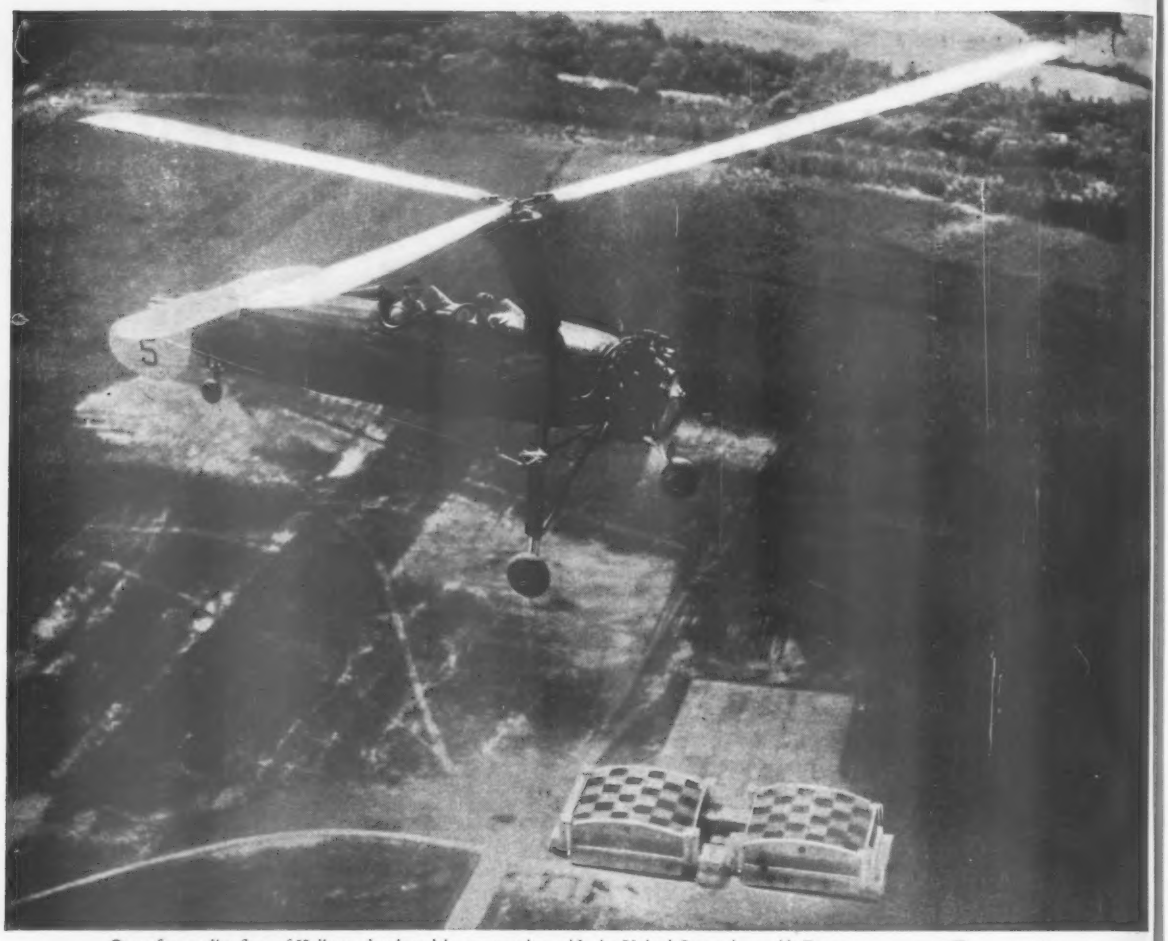
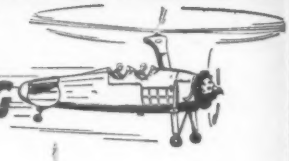


One of an earlier fleet of Kelletts, developed in cooperation with the United States Army Air Forces.



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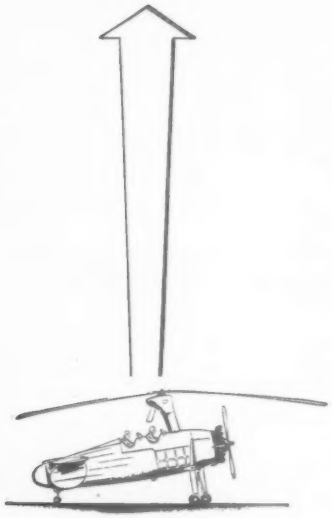

A Kellett takes off vertically, lands practically anywhere. Air speeds—from practically 0 to 120 MPH.

1944 marks the fifteenth year during which Kellett has been producing rotary wing aircraft. Each year the path of progress in this branch of aeronautical science has been extended by additional Kellett in-the-air accomplishments.

All wartime production of Kellett's advanced types of rotary wing ships is in cooperation with the United States Army Air Forces—details may not be given now.

But among many, even *pre*-war indicators of postwar opportunities to save time and cut costs for industry, commerce and agriculture, is this historic Kellett record: completing 2,607 flights in a single year, on a daily timetable, between airport and the Philadelphia post office roof, month after month, in all seasons.

When the war has been won, Kellett looks ahead to opportunities for its expanding corps of forward-looking engineers to apply their accumulated rotary wing experience to producing aircraft for patrolling electric power lines and oil pipe lines, spraying and dusting crops and orchards, oil and mineral prospecting, forestry fire prevention, transporting mail and passengers directly to urban centers. Kellett Aircraft Corporation, Upper Darby (Philadelphia), Pennsylvania.

KELLETT

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(*Continued from page* 162)

concentrations in rear areas will cause the enemy great damage and may decide the battle. This accomplishes the 'isolation of the battlefield'."

Third priority. "The destruction of selected objectives in the battle area in furtherance of the combined air-ground effort, teamwork, mutual understanding, and co-operation are essential for the success of the combined effort in the battle area. In order to obtain the necessary close teamwork the command posts of tactical air force and of the ground force concerned should be adjacent or common, at least during this phase of operations.

"Air and ground commanders profit greatly from the other's successes. Airplanes destroyed on an enemy airdrome and in the air can never attack our troops. The advance of ground troops often makes available new airdromes needed by the air forces. Massed air action on the immediate front will pave the way for an advance.

"However, in the zone of contact, missions against hostile units are most difficult to control, are most expensive, and are, in general, least effective. Targets are small, well-dispersed and difficult to locate. In addition, there is always a considerable chance of striking friendly forces due to errors in target designation, errors in navigation, or to the fluidity of the situation. Such missions must be against targets readily identified from the air and must be controlled by phase lines, or bomb safety lines which are set up and rigidly adhered to by both ground and air units. Only at critical times are contact zone missions profitable."

The *air defense* command establishes a direct defense against hostile air operations "as distinguished from the indirect defense afforded by counter air force operations. Air defense comprises all other methods designed to prevent, to interfere with, or to reduce the effectiveness of hostile air action.

Air defense is divided into active air defense and passive air defense. The former comprises all measures aimed to destroy or to threaten destruction of hostile aircraft and their crews in the air. It is provided by fighter aircraft, antiaircraft artillery and small arms fire; and by obstacles, principally barrage balloons. Passive air defense is provided by dispersion, camouflage, blackouts and other measures which serve to minimize the effect of hostile air attack.

Areas of responsibility for active air defense will be prescribed by the air force commander. Normally, the tactical air force will be responsible for the active air defense of the battle area, utilizing fighter aircraft and the mobile aircraft warning service.

"When antiaircraft artillery, searchlights and barrage balloons operate in the air defense of the same area with aviation, the efficient exploitation of the special capabilities of each, and the avoidance of unnecessary losses to friendly aviation, demand that all be placed under the command of the air commander responsible for the area. This must be done."

Antiaircraft artillery attached or assigned to ground forces combat units remain under the command of the ground force unit commander.

The *air service command,* fourth major component of an air force, provides the logistical framework of the air force. Its functions comprise such activities as procurement, supply, repair, reclamation, construction, transportation, salvage and other services required by the tactical units of an air force. The air service command provides all repair and maintenance of equipment beyond the responsibility of first and second echelons of maintenance.

All air force service organizations and installations are under the air service commander's direct control. These organizations and installations include air quartermaster, ordnance, signal, chemical, medical and engineer depots and service centers. "Where ground force depots supplying material *common to both ground and air forces* are adequate, suitably located and can be used, such material should not be handled by an air force depot."

The service center is a mobile organization provided to establish and operate the necessary third echelon maintenance, reclamation and supply points within close supporting distance of the combat units. Service centers normally are set up on the basis of one for each two combat groups. END

Dabuaer!

EVERY so often the grim, regulation Navy scowl is cracked by something like this item from the December, 1943, issue of the Bureau of Naval Personnel Information Bulletin. The heading on it reads: "If we had our own way about using dispatch phrases in speedletters . . .":

WHADURDES—What in hell does your dispatch of (date) mean?

URDESBUL—Your dispatch of (date) so much bull and I will ignore same.

DABUAER—Damn the Bureau of Aeronautics!!! (DABUSHIPS, DABUORD, DABUPERS, etc.)

DONLIM—Don't lie to me, young man!!!

DONFLYHAN—Don't fly off the handle—I'll expedite it.

FURYU—Furiously yours, I remain.

METOC—Meet me at the Officers' Club and we will discuss your problems comfortably at (time).

RELSAW—When relieved, say "hello" to the gals in Frisco for me.

DIHEARJONES—Did you ever hear the story about John Paul Jones?

INEVORGSOB—In every organization there's always some dumb etc., etc.

DONDODODOSA—Don't do as I do, do as I say.

FUBINAL—If you had been in the Aleutians as long as I have, etc.

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Fort vs. Lib

(*Continued from page 49*)

The *Fortress* had proved again and again its amazing defensive power and devastating formation bombing in action over Germany.

But aeronautical development moves quickly. In the past few months designs have progressed. Latest models are the B-17G and the B-24H and B-24J. The *Fortress* has been developing steadily since July, 1935; the *Liberator* since December, 1939. Thus it is hardly surprising that the *Liberator's* turn should come to forge a little way ahead of its magnificent older rival.

Today, with all the newest modifications incorporated in the latest versions of both bombers, my selection after the most careful and detailed analysis—mathematically, operationally and from a servicing and flying viewpoint—is that the *Liberator* (the B-24J) is the outstanding day bomber of the world, ahead of the B-17G by the narrowest of margins. That is my belief; just as I am convinced, from what I saw on a recent visit to the United States, that the new Boeing *Super-Fortress* (B-29) will prove, when it flies into action, a long way the most formidable heavy bomber ever built.

Thus the pendulum swings. First Boeing is out in front with the B-17 in its successive versions up to the B-17F. Then Consolidated Vultee takes the leading position with its B-24J; and this latter version to in turn be succeeded in power by the Boeing B-29—each stage of the progression of both types bearing more hurt and destruction to the enemy. This, after all, is our common objective.

What then are the detail reasons for selection of the latest *Liberator* as the outstanding day bomber of the present? The mathematical approach balanced by operational experience was described in detail in the January issue of FLYING. Set out as a "profit and loss account," the picture looks something like this:

LATEST LIBERATOR (B-24J)

1. *Defense:* Four power-operated turrets (eight guns) plus three hand-operated guns.

2. *Load and Range:* A slightly heavier bomb load than the B-17G for a rather longer range.

3. *Speed:* A slight advantage over the latest *Fortress.*

4. *Flying Qualities:* Pleasant to fly but not quite so easy to fly in close formation as the *Fortress.*

5. *Vulnerability:* Stands up to damage well, but not quite so extraordinarily as the *Fortress.*

6. *Maintenance:* Excellent.

LATEST FORTRESS (B-17G)

1. *Defense:* Three power-operated turrets (six guns) plus five hand-operated guns.

2. *Load and Range:* A slightly smaller bomb load than the B-24J for a rather shorter, though adequate, range.

3. *Speed:* A few m.p.h. less than the latest *Liberator.*

4. *Flying Qualities:* Delightfully easy to fly. Excellent for close formation flying even when operated at great altitudes.

5. *Vulnerability:* Exceptional powers of absorption of damage. The best "get-you-home" service in the World.

6. *Maintenance:* Very good.

In fact, the longe-range hitting-power combined with the deadly turretted armament of the latest *Liberator* would seem to put it slightly ahead of the rugged excellence of the latest *Fortress.* The Emerson nose-turret of the *Liberator* is, in my experience, rather superior to the remotely controlled chin-turret of the B-17G. The top and ball turrets and the waist guns of the two types now match. The Consolidated tail turret of the B-24J has a rather greater field of fire and precision of aim than the hand controlled twin-tail guns of the *Fort.*

Even so, the two are extraordinarily close. What I have said is no reflection on the *Fortress.* I owe my life to the firepower and the toughness of the B-17G. Had it not been such a great airplane, the *Daisy June III* would not have brought back its gallant crew and myself from Le Bourget on July 14 last, when, with nose shot off, oxygen shot out, a wing tip shot up and the stabilizer shot up, it ploughed serenely home again, still in formation, having disposed of two of its more than 60 fighter assailants in no uncertain manner.

The memory of those qualities and delightful hours at its controls have instilled in me an unrivalled affection for the *Fort.* The "old lady" will continue to give magnificent service as long as this war shall last, beloved alike by her air and her ground crews. With such a past behind her and much to look forward to in the future the "old lady" bows gracefully to her 4½-years-younger rival and yields her pride of place by the narrowest of margins. Meanwhile she looks with great expectations to her glamorous daughter, the B-29, which will carry the name of Boeing to greater achievements than ever before, from the day of her first terrific debut. The Hun and the Jap have much more coming to them from the Consolidated Vultee and Boeing production lines. END.

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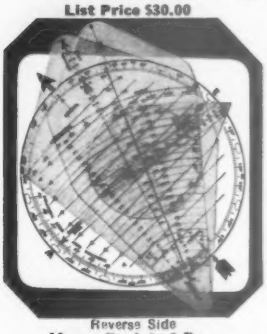

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Boypower

(*Continued from page 71*)

gating and may patent. One is a ⅜-inch box wrench to replace the open end type for installing switches on panels. The other is a new type wrench for installing pilot lights on panels.

These boys are chosen as a result of I. Q. tests, scientific block-placing and other aptitude tests, together with their school records. Like all other employees they must pass physical examinations and furnish proof of citizenship. The boys are eligible for workmen's compensation insurance and the rate of pay is the same as for adult workers. They invest part of their pay checks in war bonds and the majority of the boys at Lockheed contribute to the "buck-of-the-month club" for charity.

The four-four plan has the endorsement of leading educators and public officials, among them Walter F. Dexter, California state director of education. Vierling Kersey, superintendent of schools for the city of Los Angeles, feels that the plan has so much to recommend it that it should be continued not only through the war emergency but during normal times as well. The boys work under a constructive form of factory discipline. Failure to maintain factory work standards, failure in school subjects, or illegal absence from school result in their being separated from the payroll. END

15 YEARS AGO

FROM the February, 1929, issue of this magazine:

The McCook Field air tunnel, recently moved to Wright Field, is 96 feet long with an air stream five feet in diameter moving at a maximum velocity of 275 m.p.h.—"one of the largest ones in existence." . . . The editor urged President-elect Hoover to establish an independent air force and a secretary for aviation. . . .

The United States Department of Commerce awarded contracts covering radio equipment for 12 radio control stations, six radio beacons and 12 marker beacons to be established on the national airways at a total cost of $155,277. The Airways Division of the Lighthouse Service, which directed installation and maintenance, was already maintaining 20 radio stations on the transcontinental airways. . . .

The Guardian Aircraft Company was urging readers to "build yourself a lightplane and save over $1,500! Plans cost $5. . . ." Airway lights had been installed on more than 7,500 miles of airways and 4,000 additional miles were being lighted during the fiscal year ended June 30, 1929. . . . The new Swallow training plane, a two-place job with open cockpit, sold for $1,795 less motor and prop, flyaway Wichita. . . . Tri-motor Fokker monoplanes were being used in the Rome-Milan air service. END

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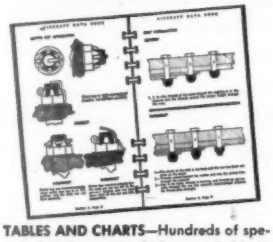

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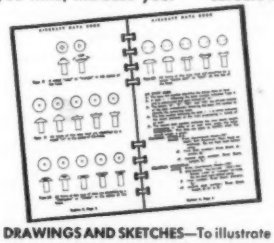

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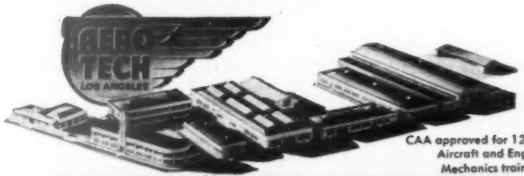

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At 81 he operates an airport. At 81 he joined the Civil Air Patrol as a member of Flight 213-3A at Montour Falls, N. Y., where he has two sons and a grandson in the same flight. Five years ago when

A. I. Martin, a pilot and airport operator at 81, is the patriarch of a flying family.

he made his solo flight he passed a physical examination for commercial pilot. He has 20/20 vision and needs no glasses.

Fifteen years ago Martin purchased 300 acres of fertile soil near the marsh lands at the head of Seneca Lake where he raised vegetable crops. In 1939, when the boys of Montour Falls became enthused about flying, "Uncle A. I.," as the youths call him, converted a portion of his farm into an airport. Twenty charter members formed the Seneca Eagles Flying Club and flying lessons were offered.

Martin's enthusiasm has made his a flying family. Daughter Ann acts as his competent assistant in managing the airport. His son, Wellington, has received a pilot's license and son, Starr, and grandson, Starr, Jr., are soloing. (His nephew, Lieut. Louis Smith, first president of the Seneca Eagles Flying Club, was killed in a crash over Corpus Christi, Tex.

Sitting at his desk in the club office he points proudly to an ox yoke and a propeller hanging side by side on the wall. He used the yoke driving oxen on his father's farm in Schuyler County. The propeller came from the plane in which he soloed 60 years later.

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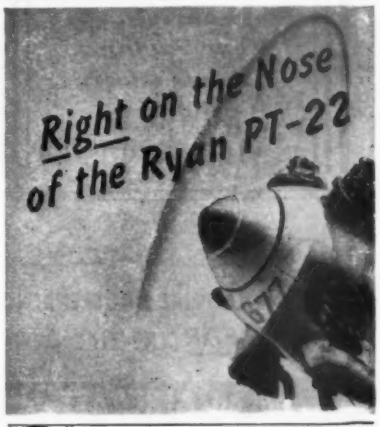

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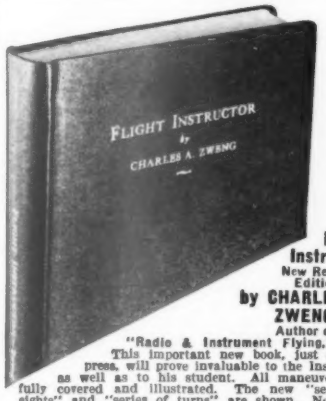

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Let the Objectives of PARKS AIR COLLEGE Help You to Achieve Leadership in Aviation

It is the Objective of Parks that:

Every graduate shall be a constructive thinker.

Every graduate shall have a well developed habit of close and persistent application.

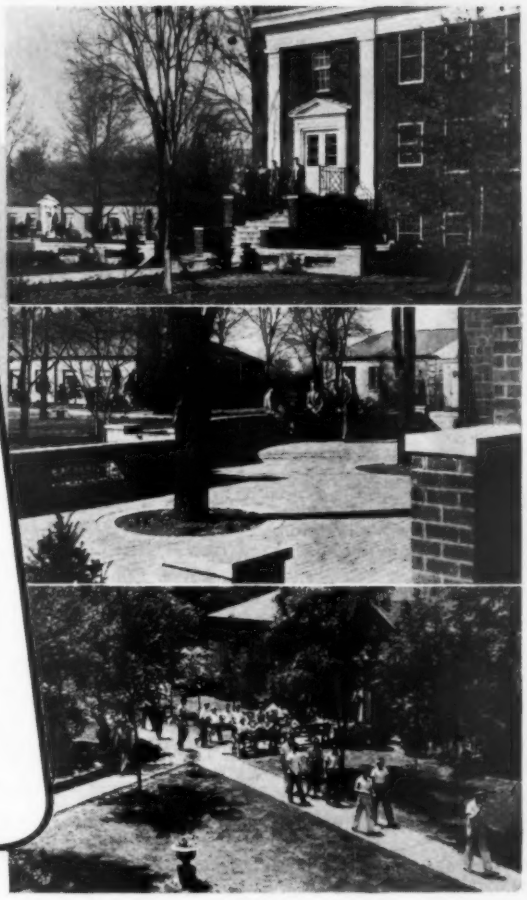
Every graduate shall be dependable, not only when convenient, but all the time.

Every graduate shall have favorable recognition in aviation and be wanted in aviation at the time of graduation.

Every graduate shall get ahead in aviation by helping aviation to get ahead.

Every graduate shall be a substantial citizen, appreciating and contributing to the American Way of Life.

PARKS



To you who are considering Aviation as your lifetime career and aspire to leadership in this ever-expanding career field, Parks Leadership Training offers a foundation on which to build that career. Each course at Parks acquaints you with basic scientific principles and vitalizes your study through the development of skill and resourcefulness in applying them to the solution of current aviation problems.

As a result of the principles underlying Parks educational methods, for more than 10 years aviation executives have been calling for Parks graduates as rapidly as they are available, and many of these men now hold some of the most responsible positions in the industry.

It will pay you well to get complete information about each of Parks four courses, *now*. Send for the free 64-page Parks catalog. Mail the coupon or a postcard request, today.

PARKS AIR COLLEGE
134 Cahokia Road East St. Louis, Illinois

Parks Recognition

PARKS AIR COLLEGE was founded August 1, 1927. Has enjoyed full Federal approval longer than any other aviation school.

Is accredited in its Aeronautical Engineering School by the Illinois Superintendent of Public Instruction.

Included since 1938 in The Directory of Colleges and Universities, issued by the United States Office of Education.

Has a capacity for enrollment of 300 commercial aviation students, also detachments of U. S. A. Air Forces Aviation Cadets.

Has its own airport with a school plant of 25 buildings devoted to school purposes entirely, also a group of fields for military flight training.

Has a faculty of 104, each especially qualified for his particular field of instruction.

Open to high school graduates with a ranking in the upper two-thirds of their classes.

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VISION • PREPARATION • LEADERSHIP

PARKS AIR COLLEGE
134 Cahokia Road
East St. Louis, Illinois

Please send me the Parks 64-page catalog giving complete details of the courses offered in commercial aviation training.

Name..... Age.....

Address.....

City..... Zone..... State.....

Enrollment limited to Male Students.
Spring Term begins March 27, 1944.